TERRAPIN MONITORING AT THE PAUL S. SARBANES ECOSYSTEM RESTORATION PROJECT AT POPLAR ISLAND

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Ohio University research personnel search for terrapin nests in the Notch

BACKGROUND

The Paul S. Sarbanes Ecosystem Restoration Project at Poplar Island, formerly known as the Poplar Island Environmental Restoration Project (PIERP), is a large-scale project that is using dredged material to restore the eroding Poplar Island in the Middle Chesapeake Bay. As recently as 100 years ago, the island was greater than 400 hectares and contained uplands and high and low marshes. During the past 100 years, the island eroded and by 1996 only three small islands (<4 hectares) remained before the project commenced. The Project Sponsors, the United States Army Corps of Engineers (USACE) and the Maryland Port Administration (MPA), are rebuilding and restoring Poplar Island to a size similar to what existed over 100 years ago. A series of stone-covered perimeter dikes facing the windward shores of PIERP were erected to prevent erosion. Dredged material from the Chesapeake Bay Approach Channels to the Port of Baltimore is being used to fill the areas within the dikes. The ultimate goals of the project are: to restore remote island habitat in the mid-Chesapeake Bay using clean dredged material from the Chesapeake Bay Approach Channels to the Port of Baltimore; optimize site capacity for clean dredged material while meeting the environmental restoration purpose of the project; and protect the environment around the restoration site. Ultimately, this restoration will benefit the wildlife that once existed on Poplar Island.

After completion of the perimeter dikes in 2002, diamondback terrapins, *Malaclemys terrapin*, began using the newly formed habitat as a nesting site (Roosenburg and Allman 2003; Roosenburg and Sullivan, 2006: Roosenburg et al., 2008, 2007; 2005; 2004). The persistent erosion of Poplar and nearby islands had greatly reduced the terrapin nesting and juvenile habitat in the Poplar Island archipelago. Prior to the initiation of the PIERP, terrapin populations in the area likely declined due to emigration of adults and reduced recruitment because of limited high quality nesting habitat. By restoring the island and providing nesting and juvenile habitat, terrapin populations utilizing the PIERP and the surrounding wetlands could increase and potentially repopulate the archipelago. The newly restored wetlands could provide the resources that would allow terrapin populations to increase by providing high quality juvenile habitat.

The PIERP is a unique opportunity to understand how large-scale ecological restoration projects affect terrapin populations and turtle populations in general. In 2002, a long-term terrapin monitoring program was initiated to document terrapin nesting on the PIERP. By monitoring the terrapin population on the PIERP, resource managers can learn how creating new terrapin nesting and juvenile habitat affects terrapin populations. This information will contribute to understanding the ecological quality of the restored habitat on the PIERP, as well as understanding how terrapins respond to large-scale restoration projects. The results of seven years of terrapin nesting surveys and juvenile captures are summarized herein to identify how diamondback terrapins use habitat created by the PIERP and how it has changed during that time.

The 2006 PIERP Framework Monitoring Document identifies three reasons for terrapin monitoring. The first is to quantify the use of nesting and juvenile habitat by diamondback terrapins on Poplar Island, including the responses to change in habitat availability as the project progresses. The second is to evaluate the suitability of terrapin nesting habitat by monitoring nest and hatchling viability, recruitment rates, and hatchling sex ratios. The third is to determine if the project affects terrapin population dynamics by increasing the available juvenile and nesting habitat on the island.

The terrapin's charismatic nature makes it an excellent species to use as a tool for environmental outreach and education. Some of the terrapin hatchlings that originate on the PIERP participate in an environmental education program in the Anne Arundel County and Baltimore City schools through Arlington Echo Outdoor Education Center (AE) and the National Aquarium in Baltimore (NAIB). These programs provide students with a scientifically-based learning experience that also allows Ohio University researchers to gather more detailed information on the nesting biology of terrapins, in addition to providing an outreach and education opportunity for the PIERP. As part of the terrapin research program at the PIERP, Ohio University researchers are collaborating with staff at AE and NAIB to foster both a classroom and field experience that uses terrapins to teach environmental education and increase awareness for the PIERP. The students raise the terrapins throughout their first winter and they attain a body size that is comparable to 2-5 year old wild individuals, thus "headstarting" their growth. The specific goals of the terrapin outreach program are:

1) Provide approximately 200 terrapin hatchlings to AE and NAIB to be raised in classrooms.
2) Obtain sex ratio data from the hatchlings through endoscopy.
3) Initiate a scientifically-based head-start program to evaluate this practice.

METHODS

Specific details of differences in surveys and sampling techniques used during 2002 - 2005 can be found in Roosenburg and Allman (2003) and Roosenburg et al. (2004; 2005, 2008). Since 2004, survey efforts to find nests were consistent and thorough. Details of the general survey methods and specific techniques employed during 2008 are described below.

Identification of terrapin nests: From 15 May to 1 August 2008, Ohio University researchers surveyed the following areas on PIERP daily: beaches in the Notch area (surrounding the northwestern tip of Coaches Island near Cell 4), areas between Coaches Island and the PIERP (outside of Cell 5), and the beach outside the dike near Cell 3 in Poplar Harbor (Figure 1). Researchers surveyed nesting areas inside the upland cell (Cell 6)occasionally to confirm the absence of nesting here because of the dike closure of Cell 6 in the Fall of 2007. The researchers also occasionally searched the periphery of Cell 4DX for signs of terrapin nesting on the surrounding dikes. A geographic positioning system (GPS) recorded nest positions and survey flags identified the specific nest locations. Upon discovering a nest, researchers examined the eggs to determine the age of the nest. If the eggs were white and chalky, they considered the nest greater than 24 hours old and no further excavation was conducted because of increased risk of rupturing the allantoic membrane and killing the embryo. Researchers excavated recent nests (less

Figure 1. Red indicates areas on the PIERP that were monitored for terrapin nests by the research team.

than 24 hours old, identified by a pinkish translucent appearance of the eggs) to count the number of eggs, and from 2004 through 2008 weighed the individual eggs. Researchers marked nests with four 7.5 cm^2 survey flags, and beginning in 2005, laid a 30 cm by 30 cm, 1.25 cm^2 mesh rat wire on the sand over the nest to deter avian nest predators, primarily crows.

Monitoring nesting and hatching success: After 45 to 50 days of incubation, researchers placed an aluminum flashing ring around each nest to prevent emerging hatchlings from escaping. Anti-predator (1.25 cm^2) wire also was placed over the ring to prevent predation of emerging hatchlings within the ring. Beginning in late July, the researchers checked ringed nests at least once daily for emerged hatchlings. Researchers brought newly emerged hatchlings to the onsite storage shed where they measured and tagged the hatchlings.

Researchers excavated nests ten days after the last hatchling emerged. For each nest, they recorded the number of live hatchlings, dead hatchlings that remained buried, eggs with dead embryos, and eggs that showed no sign of development. To estimate hatching success, researchers compared the number of surviving hatchlings to the total number of eggs from only the nests that were excavated within 24 hrs of oviposition, which provided a definite count of the number of eggs. Additionally, researchers determined if the nest was still active – with eggs that appeared healthy and had not completed development. The researchers allowed nests containing viable eggs or hatchlings that had not fully absorbed their yolk sac to continue to develop; however, researchers removed fully developed hatchlings from nests, which is further described in the next section.

Capture of hatchlings: Researchers collected hatchlings from ringed nests and also from un-ringed nests that were discovered by hatchling emergence. Additionally, researchers found a small number of hatchlings on the beach, which they collected and processed. Because a significant number of the 2008 nests over-wintered (hatchlings remaining in the nest until spring of the following year), researchers traveled to the PIERP on 30 March and 31 March 2009 to excavate and determine the fate of the over-wintering nests.

Measuring, tagging, and release of hatchlings: Researchers brought all hatchlings back to the Maryland Environmental Service (MES) shed onsite where they placed hatchlings in plastic containers with water until they were processed (measured, notched, and tagged), usually within 24 hours of capture. Researchers marked hatchlings by notching with a scalpel the 2nd right marginal scute and 9th left marginal scute establishing the cohort ID 2R9L for 2008 fall emerging hatchlings. For the first time, Ohio University personnel gave spring 2009 emerging hatchlings a different cohort ID of 2R10R (notching the 2nd right marginal scute and 10th right marginal scute) to be able to distinguish fall 2008 from spring 2009 emerging hatchlings upon later recapture. From 2002 through spring 2009 different notch codes were used to identify specific cohorts upon subsequent recapture. Researchers implanted individually marked coded wire tags (CWTs, Northwest Marine Technologies®) in all hatchlings. The CWTs were placed subcutaneously in the right rear limb using a 25-gauge needle. The CWTs should have high retention rates (Roosenburg and Allman, 2003) and in the future researchers will be able to identify terrapins originating from the PIERP for the lifetime of the turtle by detecting tag presence or absence using Northwest Marine Technologies' V-Detector.

Researchers measured plastron length, carapace length, width, and height (± 0.1 mm), and mass (± 0.1 g) of all hatchlings. Additionally, they checked for anomalous scute patterns and other developmental irregularities. Following tagging and measuring, researchers released all hatchlings in either Cell 4DX or Cell 3D. During 2002 – 2003 hatchlings were also released in the Notch. On several occasions, large numbers (>50) of hatchlings were simultaneously released but dispersed around the cell to prevent avian predation.

Measuring, tagging, and release of juveniles and adults: All juvenile and adult turtles encountered on the island were transported to the onsite shed for processing. Researchers recorded plastron length, carapace length, width, and height (±1 mm), and mass (±1 g) of all juveniles and adults. Passive Integrated Transponder (PIT, Biomark Inc.) tags were implanted in either the right rear foot or in the right inguinal region; in the loose skin anterior to the hind limb where it meets the plastron. Additionally, during all years a monel tag (National Band and Tag Company) was placed in the 9th right marginal scute. The number sequence on the tag begins with the letters PI, identifying that this animal originated on Poplar Island.

Arlington Echo Terrapin Education and Environmental Outreach Program: During 2008, 232 PIERP hatchlings were provided to the terrapin education and environmental outreach programs at AE, the NAIB, Horn Point Environmental Laboratory (HPEL), and MES. In April and May 2009, researchers traveled to AE to implant PIT tags and to perform endoscopic sex determination of 177 headstarted individuals. Researchers also measured and weighed all animals at this time. In late May and early June 2009, the AE terrapins were returned to the PIERP for release in the Notch. Unfortunately due to timing of the release, Ohio University researchers were not provided the opportunity to implant PIT tags in the terrapins that were distributed to MES or HPEL.

Researchers summarized and processed all data using Microsoft Excel® and Statistical Analysis System (SAS). Graphs were made using Sigmaplot®. Institutional Animal Care and Uses Committee at Ohio University (IACUC) approved animal use protocols (#L01-04) and Maryland Department of Natural Resources (MD DNR) – Fisheries Division issued a Scientific Collecting Permit Number 2008-74 to Willem M. Roosenburg (WMR).

RESULTS AND DISCUSSION

Nest and Hatchling Survivorship: During the 2008 terrapin nesting season (May – July), the researchers located 218 nests on the PIERP (Table 1, raw nest data provided in Appendix 1). Of these 218 nests, 180 successfully produced hatchlings and 28 nests were unsuccessful, of which predators destroyed 12 nests (Table 1). Ten nests failed because the eggs did not develop or eggs were thin-shelled which results in nest failure. Six nests were lost due to inundation by the high tide or washed out due to heavy rains because the nest site was in an area of high erosion.

YEAR	2002	2003	2004	2005	2006	2007	2008
TOTAL NESTS	68	67	182	282	191	225	218
NESTS PRODUCED HATCHLINGS	38	50	129	176	112	166	180
NESTS THAT DID NOT SURVIVE	1	7	17	70	69	44	28
DEPREDATED (ROOTS OR ANIMAL)	0	0	12	46	54	18	12
WASHED OUT	1	6	3	11	13	2	6
UNDEVELOPED EGGS, WEAK SHELLED EGGS, OR DEAD EMBRYOS	0	1	0	12	1	19	10
DESTROYED BY ANOTHER TURTLE OR NEST WAS IN ROCKS	0	0	2	0	0	3	0
DESTROYED BY BULLDOZER	0	0	0	1	0	0	0
DEAD HATCHLINGS	0	0	0	0	1	2	0
FATE OF NEST UNKNOWN	29	10	36	36	10	19	10

Table 1 - Summary of the diamondback terrapin nests found and their fate on the PIERP from 2002 to 2008

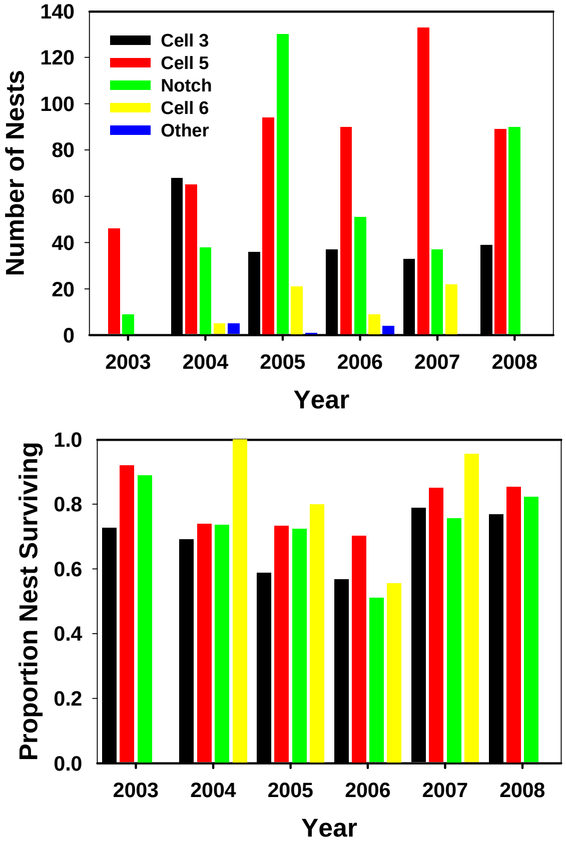

Figure 2 – The number of nests in each of the major nesting areas for each year of the study and the proportion of nests surviving

Figure 3 – Terrapin nesting locations on the PIERP during 2008

The number of terrapin nests on the PIERP has plateaued in the last three years between 200 to 225 nests per year (Table 1). During the fall of 2007, the dike closure of Cell 6 resulted in eliminating access to nesting areas inside the cell and consequently no nests were found in Cell 6 in 2008 (Figure 2 and 3). It is encouraging that the number of nests found in 2008 was consistent with the number of nests found in 2006 and 2007 despite the elimination of Cell 6 as a nesting area. Nesting activity in the Notch increased substantially and decreased in Cell 5 during 2008 (Figure 2). The nesting activity outside of Cell 3 has decreased by about 50% from its high in 2004, but has been stable for the last four years. A major reduction in the available nesting habitat occurred after tidal flow was initiated into Cell 3D (after the creation of wetlands habitat) thereby reducing the number of nests. The resulting change in current eroded the beach on the outside of the dike at Cell 3. Previously, that beach was continuous outside the dike from Cell 3A to Cell 1A; it now lies only in front of Cells 3A and 3B and in recent years, the nesting activity has declined. In 2008, the nesting activity increased in the Notch and decreased outside of Cell 5. In the spring of 2008 the turtle fence in the Notch and along Cell 5 was replaced, and as a consequence, this disturbance created much more open sand habitat preferred by terrapins for nesting. Also, some of the nesting inside of Cell 6 may have been displaced to the Notch and Cell 5, contributing to the increase in activity in the Notch.

During 2005, the predation rate by crows increased significantly (Table 1), however, no action by the terrapin researchers was taken to deter the predators at that time. In 2006, crow predation began earlier and at a higher rate, and researchers began to place a small hardware cloth in the sand over the nests. During 2007 and 2008, nest survivorship increased and reversed the decline observed from 2002-2006 (Figure 2). This increase in nest survivorship occurred because starting in 2007, researchers placed wire mesh screening over the nest immediately after processing the nest, thereby reducing the predation by crows that was the major contributing factor to the decline in nest success in previous years. During 2008, researchers continued to encounter unconfirmed nests (no egg shells present) that likely had been depredated by crows. However, crow predation success on known nests was reduced substantially because of the continued use of the wire mesh screening.

In previous years, researchers have observed willets (*Catoptrophorus semipalmatus)*, an eastern kingsnake (*Lampropeltus getulus)*, and a small mammal, most likely a shrew (*Blarina spp.)* eating terrapin nests. During the seven years of the study, researchers have noticed some predation by foxes (*Vulpes spp.*). However, the elimination of foxes from the island has stopped predation by these animals.

Researchers occasionally noted thin-shelled terrapin eggs on the PIERP. Thin-shelled eggs also have been observed in the Patuxent River terrapin population (Roosenburg, personal observation). Only a few eggs in a clutch may have thin shells, or it may affect the entire clutch. Ohio University researchers have noted that nests in which all of the eggs have thin shells are frequently broken during oviposition and seldom hatch. The cause of the thin-shelled eggs is unknown at this time, but it is not unique to the PIERP. Two possible causes that remain to be evaluated include a toxicological effect by a factor ubiquitous in the Chesapeake Bay, or a resource limitation by the females to sequester sufficient amounts of calcium to shell the eggs.

Reproductive Output: Clutch size (Analysis of Variance; ANOVA, $F_{4,546} = 1.61, P > 0.05$), clutch mass (ANOVA, $F_{4,546} = 1.20, P > 0.05$), and average egg mass (ANOVA, $F_{4,546} = 0.48, P > 0.05$) did not differ significantly from 2004 through 2008 (Table 2). Interestingly, since 2004 clutch size has been decreasing slightly. During 2002 and 2003, researchers did not collect these data. These findings indicate that there is no difference in per-clutch reproductive output from one

Year	Clutch Size	Clutch Mass (g)	Egg Mass (g)
2004	**13.68 (0.379)**	**127.55 (4.372)**	**9.80 (0.110)**
2005	**13.62 (0.245)**	**133.11 (2.541)**	**9.92 (0.087)**
2006	**13.48 (0.248)**	**133.28 (2.570)**	**9.97 (0.081)**
2007	**13.11 (0.241)**	**127.4 (2.502)**	**9.86 (0.086)**
2008	**12.90 (0.260)**	**128.0 (2.890)**	**10.06 (0.092)**

Table 2. Average and standard error of clutch size, clutch mass, and egg mass from 2004-2008 from the PIERP.

nesting season to the next.

Year	Number of Hatchlings	Mean Carapace Length (mm)	Mean Mass (g)
2002	565	31.28 (1.61)	7.52 (0.96)
2003	387	31.13 (1.50)	7.50 (0.99)
2004	1,337	31.57 (1.47)	7.61 (0.89)
2005	1,526	30.98 (1.94)	7.45 (1.10)
2006	855	30.95 (1.71)	7.38 (1.01)
2007	1,616	31.26 (1.72)	7.50 (0.91)
2008	1,443	31.03 (1.34)	7.42 (0.14)
Total	7,731		

Table 3 - Number of hatchlings, mean and standard error of carapace length, and mean mass of terrapin hatchlings caught on the PIERP from 2002-2008.

Hatchlings: Researchers captured, tagged, and notched 1,443 terrapin hatchlings on the PIERP between 1 August 2008 and 31 March 2009 (Table 3, Appendix 2). All hatchlings except for one were caught at their nests. This includes the ringed nests and 36 nests that researchers found when the hatchlings emerged. During 2002-2008, 7,731 hatchlings have been captured, tagged, and notched on the PIERP (Table 3). Hatchling production in 2008 was the third highest since the beginning of terrapin monitoring on the PIERP (Table 3). Since 2004, the number of hatchlings has been consistently greater than 1,000 animals per year. Only in 2006 when crows began preying upon nests frequently and no antipredator screens were used did the number of hatchlings drop substantially. The increase in nest survivorship and hatchling production since 2006 is an encouraging sign that the predation control is effective and that recruitment remains strong on the PIERP.

Hatchling size was similar among all years of the study (Table 3), however, because of the large number of nests at the PIERP, researchers were also able to evaluate the relationship between mean egg size within a clutch and mean hatchling size (Figure 4). This analysis was restricted to nests in which the hatching rate within the nest was 70% or higher to avoid potential bias due to differential mortality of different sized eggs. This comparison reveals some interesting results. First, mean egg mass correlates positively with mean hatchling size among clutches (Analysis of Covariance; ANCOVA, $F_{1,21} = 156.17$ $P < 0.05$, Figure 4). Although this pattern occurs in laboratory incubation of eggs from most chelonid species, this is the first *in situ* evidence that egg mass affects hatchling size in the field. Second, the data suggest that there was a significant difference in mean hatchling size among years (ANCOVA, $F_{3,212} = 2.94$ $P < 0.05$) when mean egg mass was used as a covariate. Hatchlings from 2008 were smaller than hatchlings from all previous years and hatchlings in 2006 and 2007 were smaller than those of 2004 and 2005 when corrected for variation in egg mass. The precise cause of the smaller hatchlings is unknown; however, because 2006-2008 were dryer years than 2004 and 2005, the difference may reflect dryer soil conditions that are known to affect hatchling size in the laboratory. The difference in mass is most likely due to differences in the hydration state, as dryer soils are known to negatively affect hatchling size in laboratory experiments (reviewed Packard and Packard, 1988). The difference in the hydration state is usually recovered when the hatchlings enter water. Despite their smaller size the past two years, hatchling terrapins from the PIERP generally are robust and appear healthy.

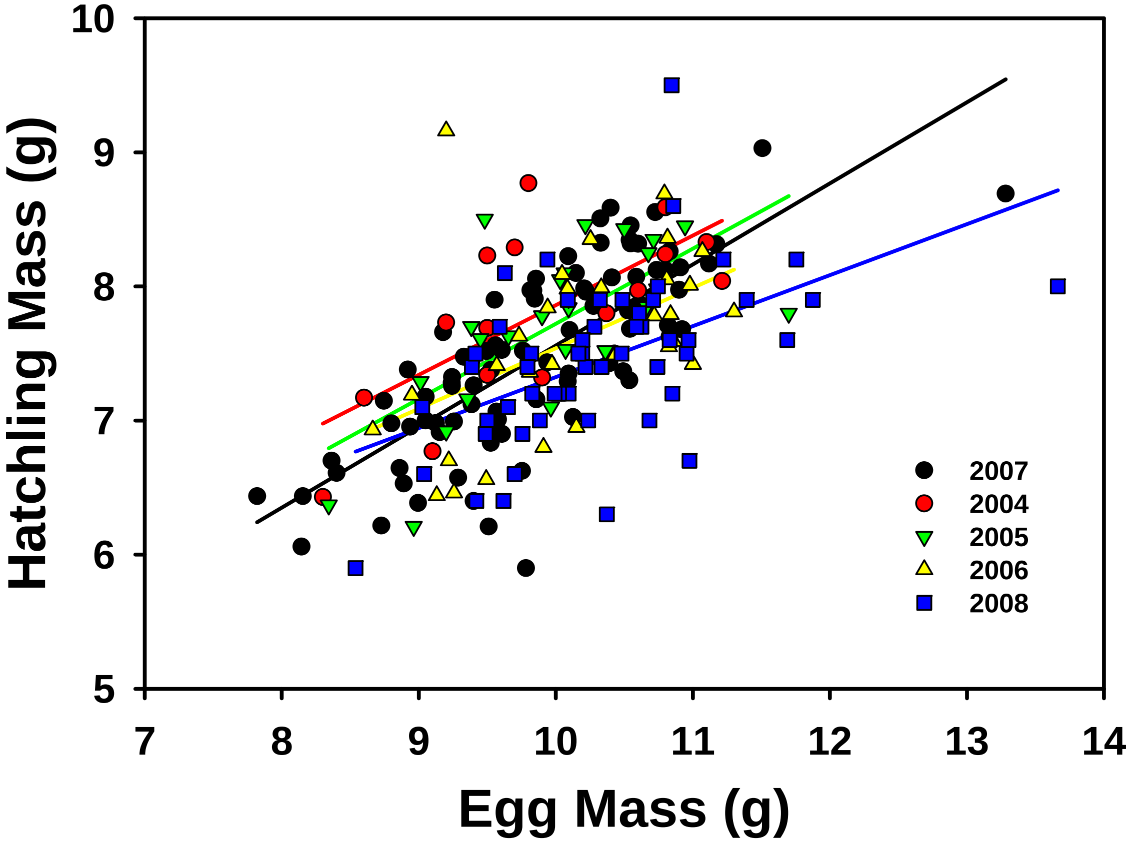

Figure 4 - The relationship between mean egg mass and mean hatchling mass for clutches in which hatching success was greater than 70%. The data suggest that hatchlings in 2007 and 2008 were smaller than in 2004 and 2005.

Over-wintering: Perhaps one of the most interesting findings of the terrapin surveys on the PIERP is the hatchling over-wintering. Prior to 2004 researchers excavated any nests that remained in the ground in late October; however, in 2004, a limited number of nests were left to over-winter *in situ*. In 2005, many of the nests that presumably would have over-wintered did not because researchers disturbed the nests in late October to insert temperature loggers in the remaining nests. During 2006 and 2007, after the middle of October most potentially over-wintering nests were neither disturbed nor excavated. During 2008, nests on the Cell 3 and Cell 5 dike perimeter beach area and the Notch were left to over-winter. Of the 183 nests in 2008 that were laid in these areas, 61.7% emerged between 2 August and 31 October and 24.0% over-wintered (Table 4). Only four (2.2%) of the 2008 over-wintering nests failed to emerge in the spring of 2009. Nest survivorship was high and similar between fall and spring emerging nests. This result suggests that the 2008 nesting season and its associated over-wintering period provided excellent conditions for terrapin incubation and nest success.

In the spring of 2009, Ohio University graduate student Leah Graham successfully completed her Master's thesis defense entitled *Diamondback terrapin,* *Malaclemys terrapin, nesting and over-wintering ecology.* This body of work describes in detail the over-wintering ecology of terrapin hatchlings on the PIERP, as well as an investigation of potential environmental cues that potentially trigger fall versus spring emergence. The major findings of the study are that the soil compaction is greater in over-wintering versus fall emerging nests, and that the presence of ice nucleating agents is greater in fall emerging nests. The findings suggest that hatchlings either become trapped by hard soil conditions, or that they must flee some nest environments because of a greater risk of freezing within the nest. A copy of M. Graham's thesis is provided in Appendix 5.

	2006	2007	2008
TOTAL NESTS - NOTCH & OUTSIDE OF CELL 5	**146**	**170**	**183**
DEPREDATED NESTS AND NESTS DESTROYED BEFORE FALL EMERGENCE	**47 (32.2%)**	**18 (10.6 %)**	**17 (9.3%)**
FALL EMERGING NESTS	**49 (33.6%)**	**92 (54.1%**	**113 (61.7%)**
NESTS OVER-WINTERING	**44 (30.1%)**	**60 (35.3%)**	**44 (24.0%)**
SPRING EMERGING NESTS	**33 (22.6%)**	**50 (29.4%)**	**40 (21.9%)**
OVER-WINTERING NESTS THAT DID NOT EMERGE	**6 13.6%**	**4 (2.4%)**	**4 (2.2%)**
UNKNOWN NESTS	**11 (7.5%)**	**6 (3.5%)**	**9 (4.9%)**
BOTH FALL & SPRING EMERGING NESTS	**1 (0.7%)**	**0 (0%)**	**1 (0.5%)**

Table 4 – Nest fate and over-wintering percentage of the nests during the 2006 – 2008 nesting seasons on the PIERP.

Adult and Juvenile Terrapins: The Ohio University researchers and MES personnel assisted in the capture of 25 adult female and 17 juvenile terrapins on the PIERP during the 2008 nesting season. Researchers marked all females with PIT tags and a monel metal tag in the 9th marginal scute on the right side. Four of the adult females were recaptures that had been marked in previous years at PIERP. Four juvenile terrapins recaptured were Arlington Echo headstart animals. Additionally, ten terrapins that were held by MES staff in the education trailer over the winter of 2008-2009 were PIT tagged in May of 2009; these terrapins were 2008 hatchlings that emerged in November of 2008 after Ohio University personnel had left and were not part of the education program. Data of all 2008 adult and juvenile captures can be found in Appendix 3.

Researchers also PIT tagged terrapins that were part of the AE program. Researchers tagged, sexed, and processed 176 terrapins in April and May 2009 (Appendix 4). Prior to PIT tagging, endoscopies were performed on these animals to determine their sex. Of the 176 animals that were part of the AE program, 146 were females, 9 were males and 21 remained undetermined. This finding indicates that the sex ratio of terrapins on the PIERP was biased toward females during the 2008 nesting season. It also suggests that incubation temperatures in most of the nests averaged above the threshold temperature of 28.2°C (temperatures that produce mixed sex ratios when incubated under constant laboratory conditions [Jeyasuria et al., 1994]). Incubating terrapin eggs above 30.0°C results in all females in the laboratory (Jeyasuria et al., 1994). Two to three weeks following the endoscopic surgery and PIT tagging, the hatchlings were transported to the PIERP and were released in the Notch area. Two AE hatchlings died accidentally during the rearing phase of the project and one died shortly after the endoscopic surgery, most likely as a result of the procedure.

CONCLUSIONS

The number of terrapin nests discovered by the research team during 2008 was very similar to 2007 and increased by 18% from 2006. Although this increase is substantial, the possibility that the increase was due to variation in the researchers' ability to find nests cannot be ruled out. Weekend rains hampered the researcher’s ability to find nests in 2006 and contributed to fewer nests being identified compared to 2005, 2007, and 2008. During the last five years, researchers have averaged 200 nests per year; suggesting that the adult female population using the PIERP for nesting is probably between 70-100 adult females. This is based on a maximum reproductive output of three clutches per year per female as has been observed in the Patuxent River population (Roosenburg and Dunham, 1997). Additionally, the 2008 nesting season resulted in 1,443 hatchlings (total of both fall 2008 and spring 2009 emerging nests). The number of hatchlings increased because of the preemptive predator control method of placing hardware cloth over the nest to deter predation by crows. Additionally, the 2008-2009 over-wintering survival of nests was similar to the previous winters. As a result, researchers marked and released approximately 430 hatchlings in the spring of 2009.

During the seven years of nesting surveys, researchers have observed an increase in the number of terrapin nests. However, the number of nests appears to have stabilized during the last five years, suggesting that the adult population in the archipelago is stable. Because of the high recruitment on the PIERP, an increase in the nesting population is anticipated, but the eight years required for females to reach reproductive maturity indicates that the increase should not be anticipated until after 2010. Only then will it be possible to determine whether the terrapin population in the archipelago is near its carrying capacity or has the potential for further growth. Ohio University researchers suspect that the long-term nesting stability on the island is most likely due to the resident population of females in the archipelago that formerly nested on Coaches and Jefferson Island and is now nesting on the PIERP.

During 2008, the researchers conducted twice daily surveys of the nesting areas. This was possible because Ryan Trimbath was dedicated full-time to locating terrapin nests and Ohio University researchers assisted him throughout the nesting season. Additionally, Ryan was able to identify 37 nests that he discovered by noting hatchlings emerging after the nesting season had ended. Many of these nests probably were laid over the weekend when nesting surveys could not be completed.

The PIERP has provided excellent nesting habitat since the completion of the perimeter dike. Nest survivorship remains high on the PIERP relative to the Patuxent River mainland population (Roosenburg, 1991). Fortunately, the decrease in nest survivorship observed during 2005 and 2006 at the PIERP was reversed by the preemptive use of hardware cloth laid over the nest to deter predation by crows beginning in 2007. During the 2004 nesting season, researchers noticed increased predation of nests by a small mammal that preyed on nests as the hatchlings emerged. In 2005, the researchers noticed that crows had learned to locate terrapin nests and excavate them. The crows depredated several nests outside Cell 5 and in the Notch. During 2005 most of the avian predation did not destroy all of the eggs in the nest. Rather, the excavation and exposure of the remaining eggs to higher than normal temperatures may have killed the embryos. Whenever possible, researchers reburied exposed nests in the hope that the eggs had not gotten too hot. In 2006, the predation of nests by crows continued, and researchers began protecting nests to reduce the predation rate because the predators had become efficient at destroying unprotected nests.

Hatchling survivorship, like nest survivorship, remains high on the PIERP relative to the Patuxent River mainland population (Roosenburg, 1991). During 2003, nest survivorship was 71% (Roosenburg et al., 2004) compared to 72% in 2004 (Roosenburg et al., 2005). The rate decreased to 67% in 2005 and 61.9% in 2006, but increased to 73.7% in 2007 and 82.6% in 2008 because of the immediate and constant use of predator deterrents. Within-nest hatchling survivorship has fluctuated among years from 93% in 2003 (Roosenburg et al., 2004) to 71% in 2004 (Roosenburg et al., 2005). Survivorship decreased in 2005 and 2006 to 66.2% and 65.7%, respectively, then rose to 79.6% for fall 2007 emerging nests and 81.9% for spring 2008 emerging nests. In 2008 within-nest survivorship remained high with 70.7% for emerging nests in the fall of 2008, and 77.1% for emerging nests in the spring of 2009. Only in 2005-2006 has survivorship of over-wintering nests (48%) been lower than fall emerging (67%) nests (Roosenburg et al., 2006). The high within-nest survivorship for 2007 and 2008 was in part due to the prevention of partial predation of nests that frequently results in exposing eggs to lethal temperatures.

Raccoons, foxes, and otters are known terrapin nest predators and contribute to low nest survivorship in areas where these predators occur, sometimes depredating 95% of the nests (Roosenburg, 1994). The lack of raccoons on the PIERP also minimizes the risk to nesting females (Seigel, 1980; Roosenburg, pers. obs.). The absence of efficient nest and adult predators on the PIERP generated nest and adult survivorship rates that are much higher compared to similar nesting areas with efficient predators. As was similarly observed in 2002 through 2007 (Roosenburg and Allman, 2003; Roosenburg et al., 2004; 2005; 2007; 2008; Roosenburg and Sullivan, 2006), the nest survivorship on the PIERP continues to be higher relative to mainland populations because of the lack of nest predators. The lack of predators and nest protection practices are resulting in strong hatchling recruitment from the PIERP.

As observed in summer 2002 through 2007 (Roosenburg and Allman, 2003; Roosenburg et al., 2004; Roosenburg and Sullivan, 2006; Roosenburg et al., 2007; Roosenburg et al., 2008), terrapin nesting on the PIERP occurred in areas where terrapins could easily access potential nesting sites. One of the major changes that occurred during the summer of 2008 was that terrapins no longer had access into Cell 6 because it was closed off in the fall of 2007, following the final PIERP site plans. This resulted in the loss of a substantial amount of nesting habitat for terrapins. Although nesting was dispersed in Cell 6, there typically were between 20-30 nests per year in this area. In 2008, researchers found almost the same number of nests as in 2007, suggesting that some of the turtles that nested in Cell 6 were nesting in the remaining nesting areas on the PIERP, the beach areas along the exterior dike of Cells 3 and 5, and the Notch. Given the high concentration of nesting in the remaining areas the development of new nesting areas becomes a critical issue for growth in terrapin nesting activity on the PIERP. As wetland cells are completed, and the exterior dikes are breached to provide tidal flow, terrapins are likely to follow and begin nesting on interior parts of the island. Researchers walked the the dike interior of Cell 4DX with the hope of finding evidence of nesting activity in 2008. Unfortunately, no evidence of nesting was observed in this area. However, several adult female terrapins have been captured on the dike between Cells 3A and 4DX.

The PIERP produced 1,446 hatchlings during the 2008 nesting season. Hatchlings started emerging from the nests on 1 August 2008; the last hatchlings were excavated on 30-31 March 2009. Researchers released all of the hatchlings in Cell 4DX and Cell 3D, however, many of the hatchlings released in September and October 2008 clearly preferred to stay on land as opposed to remaining in the water. The hatchlings produced on the PIERP in 2007 were similar in size and weight to those captured during previous studies in the Patuxent River in Maryland (Roosenburg, 1992) and in previous years on the PIERP. However, in 2008 researchers detected a 0.5g decrease in mean hatchling size when corrected for egg mass. This was most likely due to a drier nesting season in 2008. Drier incubation conditions cause smaller hatchlings when incubated under constant laboratory conditions (Packard and Packard, 1988).

The frequency of shell scute anomalies was 11.7% during 2008, similar to the scute anomaly occurrence in terrapin populations in New Jersey (10%; Herlands et al., 2004). The frequency of scute anomalies was down from the high frequency observed in 2002 through 2007 (Roosenburg and Allman, 2003, Roosenburg et al., 2004, Roosenburg et al., 2005, Roosenburg et al., 2008), particularly in 2005, when 32% of the hatchlings had shell anomalies (Roosenburg and Sullivan 2006). Warmer incubation temperatures are known to cause higher frequencies of shell scute anomalies in terrapins (Herlands et al., 2004). The high frequency of shell scute anomalies in the PIERP hatchlings could be due, in part, to the limited vegetation in the terrapin nesting areas at PIERP that could provide shaded, cooler incubation environments (Jeyasuria et al., 1994). Although shell anomalies have been associated with higher incubation temperatures, there is no evidence to suggest that these anomalies have any detrimental effects on terrapins or other turtle species. Anomalies occur at higher frequency in female terrapins than in males.

During the winter of 2008-2009, a significant number of nests over-wintered successfully. The recovery of 428 hatchlings from 40 of the 44 over-wintering nests confirms over-wintering as a successful strategy used by some terrapin hatchlings. A detailed study of hatchling over-wintering during 2006 and 2007 on the PIERP is provided in Appendix 4. Continued studies of over-wintering and spring emergence will be conducted to better understand the effect of over-wintering of the terrapin's fitness, life cycle, and natural history. The PIERP offers a wonderful opportunity to study terrapin over-wintering because of the large number of nests that survive predation.

The educational program conducted in collaboration with the AE Outdoor Education Center successfully headstarted the terrapins to facilitate sex determination. Students increased the size of the hatchlings they raised to sizes characteristic of 2-3 year old terrapins in the wild. Additionally, researchers subsequently obtained sex ratio data from the hatchlings because they were large enough for laparoscopic surgery. The sex ratio of PIERP hatchlings from 2006-2008 was heavily female biased. Furthermore, because these hatchlings were PIT tagged, the researchers intend to follow the fate of these hatchlings over the years. An integral part of this project will be to compare survivorship of naturally released hatchlings versus headstart animals that potentially have reached sizes that decrease predation vulnerability. To address this question, a multi-year mark-recapture study is needed within the Poplar Island Archipelago. The researchers initiated this portion of the terrapin monitoring program during the spring and summer of 2009.

The initial success of terrapin nesting on the PIERP indicates that similar projects also may create suitable terrapin nesting habitat. Although measures are taken on the PIERP to protect nests, similar habitat creation projects should have high nest success until raccoons or foxes colonize the project. Throughout their range, terrapin populations are threatened by loss of nesting habitat to development and shoreline stabilization (Roosenburg, 1991; Siegel and Gibbons, 1995). Projects such as the PIERP combine the beneficial use of dredged material with ecological restoration, and can create habitat similar to what has been lost to erosion and human practices. With proper management, areas like the PIERP may become areas of concentration for species such as terrapins, thus becoming source populations for the recovery of terrapins throughout the Bay.

The PIERP Framework Monitoring Document (FMD) identifies three purposes for the terrapin monitoring program. The first purpose is monitoring of terrapin nesting activity and habitat use to quantify terrapin activity on the PIERP. The current monitoring program is detailing widespread use of the island by terrapins, evidenced by a comparable number of nests found relative to mainland sites in the Patuxent River as well as the 2006 recovery of a hatchling terrapin marked on the PIERP in 2004. The second purpose is to determine the suitability of the habitat for terrapin nesting. The high nest success and hatching rates on the PIERP indicate the island provides high quality terrapin nesting habitat, albeit limited in availability because of the rock perimeter dike around most of the island. The final purpose identified by the FMD is to determine if the project is affecting terrapin population dynamics. To evaluate this effect, researchers must also conduct a mark-recapture study in combination with the continued monitoring of nesting activity. The suitability of wetland recreation as juvenile habitat remains to be determined. The stability of nesting activity on the PIERP over the past seven years strongly indicates the positive effect of the project. However, nesting surveys monitor one segment of the life cycle of the long-lived terrapin, and they have not yet continuedbeen conducted long enough to see the reproductive influence from hatchlings from originally born on the PIERP.

The PIERP Framework Monitoring Document (FMD) also identifies three hypotheses for the terrapin monitoring program. Hypothesis one is that there will be no change in the number of terrapin nests or the habitat used from year to year. The consistency in the number of nests from 2004-2008 indicates that there has been little change in the number of terrapin nests at PIERP, supporting the hypothesis. Hypothesis two states that nest and hatchling survivorship and sex ratio will differ between Poplar Island and reference sites. This hypothesis is supported as nest success and hatchling survivorship is much higher on the PIERP because of the lack of major nest predators. Similarly, sex ratio is highly female biased. At this time the third hypothesis of the FMD, which states that there will be no change in terrapin population size on Poplar Island; particularly within cells from the time the cells are filled, throughout wetland development, and after completion and breach of the retaining dike, remains undetermined as there is not enough data currently to form a conclusion.

RECOMMENDATIONS

Terrapins will continue to use the PIERP for nesting. However, some short and long-term measures can be taken to improve nesting habitat on the island.

First, the northeast expansion of the PIERP, scheduled to be implemented in 2012, provides the opportunity to create more terrapin nesting habitat in the sheltered areas of Poplar Harbor. In particular, areas to be built to the northeast of Jefferson Island would be ideal for creating terrapin nesting habitat. Although this area is proposed to be an upland cell, the creation of offshore bulkheads and backfilling of sand as illustrated in Figure 6 could provide a large amount of terrapin nesting habitat in an area where

Figure 6 – Shoreline stabilization and the creation of terrapin nesting habitat in Calvert County Maryland – Red dots indicate terrapin nests

terrapins have been seen in high concentrations (P. McGowan, personal communication). Building structures such as those illustrated in Figure 6 on the outside of the barrier dike would preclude the need to build additional fencing to prevent turtles from getting into the cells while under construction. Furthermore, nesting areas without marsh and beach grasses could be provided for terrapin nesting habitat within the cells under construction. Nesting habitat with no or limited vegetation is preferred by terrapins (Roosenburg, 1996). Because terrapins avoid nesting in areas with dense vegetation (Roosenburg 1996), providing open, sandy areas on the seaward side of the dikes should reduce efforts by terrapins to enter cells under construction to find suitable, open areas.

Second, predator control on the island will be paramount to the continued success of terrapin recruitment. Minimizing raccoon and fox populations will maintain the high levels of nest survivorship observed in 2002 through 2008. The increase in nest success due to screens over the nests is also an effective mechanism to reduce crow predation. A sustained program to eliminate mammalian predators and prevent avian predation will facilitate continued terrapin nesting success on the PIERP.

Third, Ohio University researchers should continue to investigate hatchling over-wintering on the PIERP, a study aided by the high nest survivorship on the PIERP.

Fourth, because more than 7,100 hatchlings and an additional 650 headstarted terrapins have been released on the PIERP, there is an excellent opportunity to conduct a mark-recapture study to determine 1) survivorship of hatchlings, and 2) a comparison of headstarted to immediately released hatchlings. Ohio University researchers are currently in the process of obtaining additional funding to initiate this work during the summer of 2009.

Finally, efforts to promote the use of by-catch reduction devices (BRDs) on crab pots fished in and around the PIERP archipelago will increase adult survivorship. Crab pots drown terrapins and can have dramatic effects on their populations (reviewed in Roosenburg 2004). Ohio University researchers have had a BRD research program and ongoing dialogue with MD DNR about instituting the use of BRDs in the commercial fishery. Instituting such a conservation program would be consistent with regulation efforts to close the commercial terrapin fishery. Promoting or requiring the use of BRDs in the PIERP archipelago could greatly reduce the mortality of juvenile female and male terrapins and the PIERP may be an excellent opportunity to initiate such a program in an experimental context. The five recommendations offered above will contribute to the continuing and increasing understanding of the effect of the PIERP on terrapin populations.

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Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
001	2-Jun-08	38 45.175	76 22.457	Sun	Open	Notch	11	107.6	9.78		Fate of Nest Unknown Lost overwinter
002	3-Jun-08	38 45.096	76 22.327	Sun	Open	5	13	125.1	9.62	2	Nest reported as Overwintering but two hatchlings emerged in Fall
003	3-Jun-08	38 45.094	76 22.359	Semi-Shade	Open	Notch	14	110.2	9.94	4	
004	3-Jun-08	38 45.068	76 22.420	Sun	Open	Notch	12	127.5	10.63	12	
005	5-Jun-08	38 45.652	76 22.805	Semi	Open	3	13	117.1	9.01	6	Excavated 11/3 ;
006	4-Jun-08	38 45.063	76 22.252	Sun	Open	5	12	125.5	10.46	0	
007	4-Jun-08	38 45.176	76 22.451	Sun	Open	5	12	128.2	10.68	13	In fence trench
008	5-Jun-08	38 45.989	76 22.063	Semi	Edge	5	14	158	11.16	3	
009	6-Jun-08	38 45.640	76 22.799	Sun	Open	3	17	167.6	9.86	0	
010	6-Jun-08	38 45.140	76 22.484	Sun	Open	5	14	141.3	10.09	11	
011	6-Jun-08	38 45.064	76 22.438	Sun	Open	5	12	128.9	10.74	11	
012	6-Jun-08	38 45.073	76 22.400	Sun	Open	5	11	120.5	10.95	9	
013	6-Jun-08	38 45.074	76 22.395	Full	Open	5	6	56.3	9.38	4	8/13 1 dead egg, 1 dead hatchling, strangled by roots
014	6-Jun-08	38 45.068	76 22.258	Full	Open	5	12	93.9	7.83		Emerged Shells present
015	9-Jun-08	38 45.625	76 22.782	Sun	Open	3	14	152.2	10.87		washed out 7/24
016	9-Jun-08	38 45.654	76 22.801	Sun	Open	3	Old Nest			13	8/12 1 dead hatchling, 2 dead eggs
017	9-Jun-08	38 45.660	76 22.813	Sun	Open	3	13	148.1	11.39	10	3 dead eggs
018	9-Jun-08	38 45.119	76 22.468	Sun	Open	5	13	125.7	9.67		
019	9-Jun-08	38 45.099	76 22.479	Sun	Open	5	8	87.8	10.98	10	
020	9-Jun-08	38 44.079	76 22.460	Sun	Open	5	13	114	8.77		
021	9-Jun-08	38 45.070	76 22.410	Sun	Edge	5	Old Nest			1	
022	9-Jun-08	38 44.078	76 22.377	Sun	Open	5	9	97.5	10.83	0	
023	9-Jun-08	38 44.084	76 22.369	Sun	Open	5	10	108.5	10.85	1	9 dead eggs
024	9-Jun-08	38 45.092	76 22.361	Sun	Open	5	12	100.7	10.07	0	2 Eggs Broken
025	9-Jun-08	38 45.095	76 22.329	Sun	Open	5	Old Nest			5	Emergance hole out of ring
026	9-Jun-08	38 45.091	76 22.319	Sun	Open	5	Old Nest				Emerged Shells present
027	9-Jun-08	38 45.074	76 22.274	Sun	Open	5	15	147.3	9.82	12	
028	9-Jun-08	38 45.065	76 22.241	Sun	Open	5	17	160	9.41	6	dug up 8/13 7 dead eggs and 1 dead hatchling, strangled by roots
029	9-Jun-08	38 45.043	76 22.205	Sun	Open	5	Old Nest			11	

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
030	9-Jun-08	38 45.023	76 22.150	Sun	Open	5	15	148.3	9.89	10	5 dead eggs
031	9-Jun-08	38 45.013	76 22.130	Sun	Open	5	Old Nest			18	
032	9-Jun-08	38 45.013	76 22.127	Sun	Open	5	Old Nest			0	2 Eggs Broken - thin. shelled
033	9-Jun-08	38 45.012	76 22.127	Sun	Open	5	Old Nest			9	
034	9-Jun-08	38 45.008	76 22.114	Sun	Open	5	15	135.5	9.03	0	
035	9-Jun-08	38 45.008	76 22.119	Sun	Open	5	11	79.8	7.25	1	Hatched 8/13 1 dead hatchling and 9 dead eggs
036	9-Jun-08	38 45.022	76 22.110	Sun	Open	5	14	161.5	11.22	11	1 dead egg
037	9-Jun-08	38 44.968	76 22.011	Sun	Open	5	13	141.5	10.88	6	8 dead eggs
038	9-Jun-08	38 44.690	76 22.003	Sun	Open	5	16	155.9	9.74	11	
039	9-Jun-08	38 44.960	76 21.997	Sun	Open	5	Old Nest				
040	9-Jun-08	38 44.958	76 21.992	Sun	Open	5	11	10.3	9.63		
041	9-Jun-08	38 44.675	76 22.020	Sun	Open	5	Old Nest			7	Dug up 8/13 3 dead eggs, 1 w/ maggots
042	9-Jun-08	38 45.144	76 22.475	Sun	Open	5	13			12	
043	9-Jun-08	38 45.207	76 22.429	Sun	Open	5	Old Nest			13	
044	10-Jun-08	38 45.083	76 22.371	Sun	Open	5	9	105.8	11.76	9	
045	10-Jun-08	38 45.099	76 22.338	Semi	Open	5	16	150.2	9.39	16	
046	10-Jun-08	38 45.093	76 22.346	Sun	Open	5	Old Nest			11	
047	10-Jun-08	38 44.979	76 22.048	Sun	Open	5	12	146.5	12.21	8	2 dead eggs
048	12-Jun-08	38 45.096	76 22.345	Sun	Open	5	12	111.2	9.27		
049	13-Jun-05	38 45.671	76 22.810	Sun	Open	5	14	146.7	10.48	13	
050	16-Jun-08	38 45.652	76 22.801	Sun	Open	3	11	105.5	9.59	10	1 dead egg
051	16-Jun-08	38 45.665	76 22.806	Sun	Open	3	Old Nest			5	
052	16-Jun-08	38 45.668	76 22.809	Sun	Open	3	Old Nest			25	Hatched 8/12 25 hatchlings plus 1 dead, Maybe 2 nests
053	16-Jun-08	38 45.101	76 22.479	Sun	Open	5	13	140.8	10.83	15	
054	16-Jun-08	38 45.092	76 22.478	Sun	Open	5	17	180.9	10.64	yes	5 dead eggs
055	16-Jun-08	38 45.085	76 22.468	Sun	Open	5	17	184.5	10.85	4	Emerged Shells present
056	16-Jun-08	38 45.072	76 22.446	Sun	Open	5	16	175.5	10.97	12	
057	13-Jun-05	38 45.071	76 22.400	Sun	Open	5	24	232	10.09	19	1 egg broken
058	16-Jun-08	38 45.080	75 22.378	Sun	Open	5	11	113.1	10.28	11	

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
059	16-Jun-08	38 45.041	76 22.196	Sun	Open	5	Old Nest				Emerged Shells present
060	17-Jun-08	38 45.041	76 23.196	Sun	Open	5	15	177.2	11.81	9	
061	17-Jun-08	38 45.095	76 22.477	Sun	Open	5	13	132.5	10.19	13	
062	17-Jun-08	38 45.073	76 22.395	Sun	Open	5	Old Nest			24	1 dead egg
063	17-Jun-08	38 45.083	76 22.379	Sun	Open	5	12	124	10.33	12	
064	17-Jun-08	38 45.088	76 22.307	Sun	Open	5	11	105.8	9.62	11	
065	17-Jun-08	38 45.055	76 22.232	Sun	Open	5	12	122.6	10.22	12	
066	18-Jun-08	38 45.111	76 22.480	Sun	Open	5	14	148.5	10.61	10	Captured female PI 0033
067	18-Jun-08	38 45.090	76 22.319	Sun	Open	5	14	155.8	11.13		Captured female PI 0034
068	18-Jun-08	38 44.969	76 22.020	Sun	Open	5	14	140.2	10.01	14	
069	19-Jun-08	38 45.041	76 22.242	Sun	Open	5	13	123.5	9.50	10	Hatched 8/12 , 3 eggs unaccounted for
070	19-Jun-08	38 45.017	76 22.132	Sun	Open	5	14	135.1	9.65	10	
071	19-Jun-08	38 44.957	76 22.010	Sun	Open	5	15	149.3	9.95	13	
072	19-Jun-08	38 35.093	76 22.479	Sun	Open	5	1	9.2	9.20	1	Turtle PI 0059, disturbed from nest and laid 1 egg after captured
073	20-Jun-08	38 45.654	76 22.795	Sun	Open	3	15	166.2	11.08	1	1 egg laid as turtle was leaving nest
074	20-Jun-08	38 45.662	76 22.806	Sun	Open	5	13	137.1	10.55	13	
075	20-Jun-08	38 45.142	76 22.477	Sun	Open	5	13	111	8.54	13	
076	20-Jun-08	38 45.098	76 22.479	Sun	Open	5	10	107.1	10.71	10	
077	20-Jun-08	38 45.077	76 22.454	Sun	Open	5	14	144.5	10.32	13	Laid by PI 0063
078	20-Jun-08	38 45.062	76 22.254	Sun	Open	5	16	163.1	10.19	10	Hatched 8/12 1 dead egg, 5 dead hatchlings, stabbed by heron throught mesh
079	20-Jun-08	38 45.042	76 22.202	Sun	Open	5	16			14	
080	20-Jun-08	38 45.007	76 22.108	Sun	Open	5	16	156.1	9.76	15	
081	20-Jun-08	38 45.006	76 22.105	Sun	Open	5	13	110.4	8.49	0	1 dead egg
082	20-Jun-08	38 44.988	76 22.065	Sun	Open	5	16	173.7	10.86	16	
083	23-Jun-08	38 45.111	76 22.479	Sun	Open	5	Old Nest			0	
084	23-Jun-08	38 45.102	76 22.478	Sun	Open	5	Old Nest			12	
085	23-Jun-08	38 45.070	76 22.412	Sun	Open	5	13	117.5	9.04	12	
086	23-Jun-08	38 45.071	76 22.400	Sun	Open	5	13	122.5	9.42	4	6 dead eggs 3 dead hatchlings with roots ants and maggotts

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
087	23-Jun-08	38 45.060	76 221.249	Sun	Open	5	Old Nest				
088	23-Jun-08	38 45.018	76 22.143	Sun	Open	5	Old Nest			15	
089	23-Jun-08	38 45.016	76 22.139	Sun	Open	5	Old Nest			2	
090	23-Jun-08	38 44.998	76 22.127	Sun	Open	5	Old Nest			16	
091	23-Jun-08	38 44.998	76 22.083	Sun	Open	5	Old Nest			5	3 dead eggs
092	23-Jun-08	38 44.967	76 22.018	Sun	Open	5	14	143.3	10.24	13	
093	23-Jun-08	38 44.965	76 22.012	Sun	Open	5	18	166.1	9.23		Temperature logger found on beach 6/24. Nest was probably washed out(unable to relocate)
094	24-Jun-08	38 45.644	76 22.792	Sun	Open	3	12	135.7	11.31	8	2 dead hatchlings 1 dead egg
095	24-Jun-08	38 45.067	76 22.418	Sun	Open	5	Old Nest				
096	24-Jun-08	38 45.016	76 22.117	Sun	Open	5	10	83.9	8.39	11	
097	24-Jun-08	38 44.974	76 23.040	Sun	Open	5	Old Nest			7	3 dead eggs
098	24-Jun-08	38 45.965	76 22.010	Sun	Open	5	12	122.9	10.24	9	
099	24-Jun-08	38 45.668	76 22.809	Sun	Open	3	13	129.2	9.94	13	
100	26-Jun-08	38 44.671	76 22.811	Sun	Open	3				0	Egg shells very thing, I do not think they will develop, 5 eggs "broken" during excavation
101	27-Jun-08	38 45.111	76 22.480	Sun	Open	5	19	173.3	9.63	14	1 egg broken
102	30-Jun-08	38 45.667	76 22.808	Sun	Open	5	9	93.9	10.43	3	
103	30-Jun-08	38 45.205	76 22.430	Sun	Open	5	Old Nest				
104	30-Jun-08	38 45.187	76 22.444	Sun	Open	5	Old Nest			14	1 dead egg
105	30-Jun-08	38 45.173	76 22.456	Sun	Open	5	12	142.5	11.88	12	
106	30-Jun-08	38 45.119	76 22.473	Sun	Open	5	Old Nest			13	
107	30-Jun-08	38 45.109	76 22.480	Sun	Edge	5	Old Nest			14	
108	30-Jun-08	38 45.083	76 22.461	Sun	Open	5	13	123.1	9.47	8	5 dead eggs
109	30-Jun-08	38 45.078	76 22.459	Sun	Open	5	11	150.3	13.66	8	3 dead eggs
110	30-Jun-08	38 45.054	76 22.375	Sun	Open	5	13	130.3	10.02	12	

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
111	30-Jun-08	38 45.090	76 22.315	Sun	Open	5	Old Nest			2	
112	30-Jun-08	38 45.090	76 22.317	Sun	Open	5	14	137.6	9.83	14	
113	30-Jun-08	38 45.051	76 22.214	Sun	Open	5	Old Nest				
114	30-Jun-08	38 45.005	76 22.106	Sun	Open	5	9	105.2	11.69	8	1 dead hatchling
115	30-Jun-08	38 44.960	76 22.000	Sun	Open	5	13	128	9.85	7	1 dead egg
116	1-Jul-08	38 45.663	76 22.807	Sun	Open	3	13	130.7	10.05	0	whole nest killed by plant roots
117	1-Jul-08	38 44.998	76 22.057	Sun	Open	5	10	105.3	10.53	2	Emerged egg shells found when dug in the spring, some hatchlings may have escaped
118	2-Jul-08	38 45.094	76 22.481	Sun	Open	5	14	142.3	10.16	15	
119	2-Jul-08	38 45.028	76 22.167	Sun	Open	5	16	146.9	9.79	15	1 egg broken
120	2-Jul-08	38 45.629	76 22.790	Sun	Open	3	17	123.4	7.26		Washed out 8/28
121	3-Jul-08	38 45.647	76 22.798	Sun	Open	3	13	127.4	9.80		11/3 ring disturbed by storm, but hatchlings escaped
122	3-Jul-08	38 45.126	76 22.482	Sun	Open	5	15	138.1	9.21	4	1 dead egg
123	3-Jul-08	38 45.094	76 22.319	Sun	Open	5	11	123.1	11.19		Emerged egg shells found when dug in the spring, hatchlings had escaped
124	3-Jul-08	38 45.071	76 22.272	Sun	Open	5	14	146.8	10.49	14	
125	3-Jul-08	38 45.025	76 22.158	Sun	Open	5	16	144.4	9.03	14	
126	3-Jul-08	38 45.005	76 22.104	Sun	Open	5	11	114.1	10.37	9	2 dead eggs
127	3-Jul-08	38 44.961	76 21.999	Sun	Open	5	14	132.4	9.46	yes	3 dead eggs
13	7-Jul-08	38 45.643	76 22.796	Sun	Open	3	Old Nest			13	
129	7-Jul-08	38 45.662	76 22.809	Semi	Edge	3	Old Nest			yes	Hatched 8/14 38 days after found, before ring was set up, 2 dead eggs
130	7-Jul-08	38 45.667	76 23.809	Sun	Open	3	Old Nest			14	
131	7-Jul-08	38 45.202	76 22.426	Sun	Open	5	Old Nest				
132	7-Jul-08	38 45.109	76 22.481	Sun	Open	5	Old Nest			13	
133	7-Jul-08	38 45.110	76 22.481	Sun	Edge	5	Old Nest			Yes	Emerged outside of ring
134	7-Jul-08	38 45.094	76 22.480	Sun	Open	5	Old Nest			Yes	26 Hatchlings suggesting 2 nests

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
135	7-Jul-08	38 45.092	76 22.477	Sun	Open	5	Old Nest			10	
136	7-Jul-08	38 45.085	76 22.471	Sun	Open	5	Old Nest			11	
137	7-Jul-08	38 45.070	76 22.448	Sun	Open	5	Old Nest			13	
138	7-Jul-08	38 45.066	76 22.430	Sun	Open	5	Old Nest			7	
139	7-Jul-08	38 45.106	76 22.391	Sun	Open	5	Old Nest			13	
140	7-Jul-08	38 45.091	76 22.312	Sun	Open	5	Old Nest				
141	7-Jul-08	38 45.038	76 22.314	Sun	Open	5	Old Nest				fully predated when found
142	7-Jul-08	38 45.087	76 22.306	Sun	Open	5	Old Nest			2	
143	7-Jul-08	38 45.078	76 22.286	Sun	Open	5	Old Nest				
144	7-Jul-08	38 45.045	76 22.208	Sun	Open	5	Old Nest				
145	7-Jul-08	38 45.009	76 22.139	Sun	Open	5	Old Nest			15	
146	7-Jul-08	38 45.004	76 22.107	Sun	Open	5	Old Nest			7	
147	7-Jul-08	38 44.972	76 22.027	Sun	Open	5	15	141.2	9.41	13	
148	7-Jul-08	38 45.628	76 22.784	Sun	Open	3	15	144.4	10.31		Nest moved 25' from road onto beach
149	7-Jul-08	38 45.673	76 22.809	Sun	Open	3	11	119.3	10.85	11	
150	8-Jul-08	38 45.619	76 22.777	Sun	Open	3	Old Nest			11	Nest found on the side of road, too old to move, should be safe
151	8-Jul-08	38 44.969	76 22.017	Sun	Open	5	9	96.7	10.74	8	
152	8-Jul-08	38 44.961	76 22.001	Sun	Open	5	16	173.6	10.85	14	1 egg broken
153	9-Jul-08	38 44.669	76 22.807	Sun	Open	3	?			10	Eggs did not properly develop, thin shelled and broken
154	9-Jul-08	38 45.072	76 22.400	Sun	Edge	5	1				Old nest found predated, 1 egg remains
155	9-Jul-08	38 45.002	76 22.102	Sun	Open	5	14			10	scale not functioning, 3 dead eggs

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
156	9-Jul-08	38 45.092	76 22.288	Sun	Open	5	Old Nest			11	
157	10-Jul-08	38 44.965	76 21.997	Sun	Open	5	15	151.5	10.10	9	laid by PI 0067
158	11-Jul-08	38 45.125	76 22.480	Sun	Edge	5	13	129.2	9.94		
159	11-Jul-08	38 45.067	76 22.440	Sun	Open	5	10	106.1	10.61	1	
160	14-Jul-08	38 45.676	76 22.810	Open	Sun	3	Old Nest				
161	15-Jul-08	38 45.648	76 22.805	Semi	Open	3	7	51.9	7.41	3	
162	15-Jul-08	38 45.098	76 22.488	Sun	Edge	5	11	109.9	9.99	10	1 dead egg
163	15-Jul-08	38 45.076	76 22.452	Sun	Open	5	Old Nest				
164	16-Jul-08	38 45.143	76 22.478	Sun	Edge	5	Old Nest			1	all but one hatched outside of ring
165	16-Jul-08	38 45.125	76 22.478	Sun	Open	5	10	94.2	9.42	9	Nest likely laid by PI 0027, found heading towards water in close proximity to nest(very fresh)
166	16-Jul-08	38 44.985	76 22.062	Sun	Open	5	10	108.5	10.85	9	
167	17-Jul-08	38 45.622	76 22.783	Sun	Open	3	15	128.1	8.54		Washed out 7/23/08
168	17-Jul-08	38 45.662	76 22.805	Sun	Open	3	13	117.9	9.07	8	5 dead eggs
169	17-Jul-08	38 45.668	76 22.808	Sun	Open	3	9	85.7	9.52	4	9/25 washed out, dug up, 3 eggs remain
170	17-Jul-08	38 45.070	76 22.396	Open	Edge	5	13	124.2	9.55		
171	17-Jul-08	38 44.991	76 22.076	Sun	Open	5	Old Nest			13	
172	21-Jul-08	38 45.076	76 22.302	Sun	Open	5	16	151.8	9.49	16	
173	21-Jul-08	38 45.058	76 22.234	Sun	Open	5	Old Nest			9	
174	21-Jul-08	38 45.036	76 22.183	Sun	Open	5	Old Nest			6	
175	22-Jul-08	38 45.659	76 22.801	Sun	Open	3	8	84.7	10.59	7	
176	22-Jul-08	38 45.080	76 22.383	Sun	Open	5	12	118.6	9.88	11	
177	23-Jul-08	38 45.070	76 22.400	Sun	Edge	5	7	59.2	8.46	4	Root growing into nest chamber
178	23-Jul-08	38 45.205	76 22.416	Sun	Open	5	5	46.3	9.26		
179	28-Jul-08	38 45.088	76 22.361	Sun	Open	5	Old Nest			15	
180	30-Jul-08	38 45.667	76 22.773	Sun	Open	3	Old Nest				nest lost in storm 9/7

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
181	30-Jul-08	38 45.648	76 22.805	Sun	Open	3	Old Nest				
182	30-Jul-08	38 45.073	76 22.389	Sun	Open	5	11	106.7	9.70	10	
183	5-Aug-08	38 45.061	76 22.240	Sun	Open	5				yes	1 dead egg
184	5-Aug-08	38 45.048	76 22.214	Sun	Open	5				yes	
185	7-Aug-08	38 45.643	76 22.801	Sun	Open	3				yes	2 hatchlings found
186	7-Aug-08	38 45.668	76 22.813	Sun	Open	3				yes	1 dead egg
187	8-Jul-08	38 44.978	76 22.042	Sun	Open	5				yes	
188	12-Aug-08	38 45.653	76 22.814	Sun	Open	5				yes	
189	14-Aug-08	38 45.116	76 22.480	Sun	Open	5				yes	
190	17-Aug-08	38 45.640	76 22.795	Sun	Open	3				yes	1 hatchling found, unable to locate nest
191	18-Aug-08	38 45.042	76 22.185	Sun	Open	5				yes	
192	20-Aug-08	38 45.633	76 22.786	Sun	Open	3				yes	
193	20-Aug-08	38 45.629	76 22.786	Sun	Open	3				yes	1 hatchling
194	22-Aug-08	38 45.662	76 22.806	Sun	Open	3				yes	
195	22-Aug-08	38 45.062	76 22.254	Sun	Open	5				yes	2 hatchlings collected
196	25-Aug-08	38 45.070	76 22.403	Sun	Open	5				yes	
197	26-Aug-08	38 45.024	76 22.154	Sun	Open	5				yes	
198	28-Aug-08	38 45.070	76 22.408	Sun	Open	5				yes	1 hatchling 2 dead w/ maggots
199	28-Aug-08	38 45.092	76 22.478	Sun	Open	5				yes	Nest in the same ring as nest # 54, hatchlings mixed
200	28-Aug-08					5				1	Hatchling found wandering along fence on PI side, unable to locate nest
201	28-Aug-08	38 45.094	76 22.486	Sun	Open	5				yes	Found in the same ring as nest #134
202	11-Sep-08	38 45.009	76 22.118	Sun	Open	5				6	6 hatchlings and 3 dead eggs
203	11-Sep-08	38 44.958	76 21.985	Sun	Open	5				yes	
204	11-Sep-08	38 44.968	76 22.019	Sun	Open	5				yes	
205	9-Sep-08	38 45.033	76 22.175	Sun	Open	5				yes	
206	11-Sep-08	38 45.063	76 22.248	Sun	Open	5				yes	
207	11-Sep-08	38 45.066	67 22.262	Sun	Open	5				yes	
208	11-Sep-08	38 45.079	76 22.277	Sun	Open	5				yes	
209	11-Sep-08	38 45.075	76 22.393	Sun	Open	5				yes	
210	11-Sep-08			Sun	Edge	5				yes	
211	11-Jul-05	38 45.071	76 22.446	Sun	Edge	5				yes	1 dead egg
212	11-Jul-05	38 45.082	76 22.464	Sun	Edge	5				yes	
213	11-Jul-05	38 45.131	76 22.474	Sun	Edge	5				yes	
214	17-Jul-05	38 45.069	76 22.263	Sun	Open	5				yes	1 dead egg

Nest	Date	Latitude	Longitude	Exposure	Area	Cell #	Clutch Size	Total Mass	Mean Egg Mass	Hatched	Comment
215	17-Jul-05	38 44.963	76 22.002	Sun	Open	5				yes	
216	17-Jul-05	38 45.089	76 23.319	Sun	Open	5				yes	
217	17-Jul-05	38 45.089	76 23.319	Sun	Edge	5				1	1 hatchling, 1 dead egg
218	17-Jul-05	38 45.076	76 22.383	Sun	Open	5				yes	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
1-Aug-08	3116		2R9L	Nest	28	27.2	31.1	26.5	15.0	7.0	
1-Aug-08	3117	3118	2R9L	Nest	28	27.0	30.4	26.8	15.5	7.0	
1-Aug-08	3119		2R9L	Nest	28	27.8	31.0	26.9	15.1	7.2	
1-Aug-08	3121		2R9L	Nest	28	28.6	32.6	27.7	15.7	7.6	
1-Aug-08	3122	3123	2R9L	Nest	28	26.6	31.4	28.8	16.2	7.7	13 Marg.(R)
1-Aug-08	3124		2R9L	Nest	5	28.2	31.8	26.9	15.8	6.9	
1-Aug-08	3126		2R9L	Nest	5	26.8	30.8	27.2	16.1	7.0	
1-Aug-08	3127		2R9L	Nest	5	26.7	30.2	26.8	15.4	6.8	
1-Aug-08	3129		2R9L	Nest	5	26.7	30.2	26.9	14.5	6.6	
1-Aug-08	3130	3131	2R9L	Nest	5	26.7	31.0	26.8	14.4	6.7	
1-Aug-08	3132		2R9L	Nest	5	26.5	29.5	26.2	14.7	6.7	
1-Aug-08	Dead		2R9L	Nest	28	26.5	30.2	26.6	16.2		Died overnight
4-Aug-08	3134		2R9L	Nest	12	27.5	31.0	26.5	16.2	7.3	
4-Aug-08	3135	3136	2R9L	Nest	12	25.6	29.5	25.8	15.7	6.5	
4-Aug-08	3137		2R9L	Nest	12	26.5	30.0	25.8	15.6	6.5	
4-Aug-08	3138	3139	2R9L	Nest	12	27.8	31.6	27.7	17.1	8.3	
4-Aug-08	3140		2R9L	Nest	12	28.4	31.8	27.9	16.9	8.0	
4-Aug-08	3142		2R9L	Nest	12	26.0	30.1	26.4	16.4	6.5	
4-Aug-08	3143	3144	2R9L	Nest	12	27.9	31.8	28.8	17.1	8.2	
4-Aug-08	3145		2R9L	Nest	12	27.9	31.8	28.6	17.1	8.2	
4-Aug-08	3146	3147	2R9L	Nest	12	27.7	31.9	27.9	17.9	8.1	
5-Aug-08	3148		2R9L	Nest	41	24.2	27.2	25.1	13.4	5.3	
5-Aug-08	3150		2R9L	Nest	41	25.2	29.0	25.5	14.4	6.0	
5-Aug-08	3152	3153	2R9L	Nest	41	22.2	26.0	23.6	14.1	5.3	13 Marg.(R), tag 03151 injected and undetected,probably not act. injected
5-Aug-08	3154	3155	2R9L	Nest	41	25.1	28.3	25.2	15.0	5.6	
5-Aug-08	3156		2R9L	Nest	41	24.0	27.5	25.7	14.2	5.5	
5-Aug-08	3158		2R9L	Nest	41	24.4	27.4	24.6	14.1	5.4	
5-Aug-08	3159	3160	2R9L	Nest	41	24.3	28.0	25.7	14.3	5.7	
7-Aug-08	3161		2R9L	Nest	185	27.0	30.5	27.1	17.0	8.4	
7-Aug-08	3163		2R9L	Nest	185	27.3	30.1	26.4	17.1	8.4	
12-Aug-08	3164	3165	2R9L	Nest	73	26.9	30.9	26.8	16.9	8.3	
12-Aug-08	3166		2R9L	Nest	52	29.0	32.7	29.8	16.3	8.3	
12-Aug-08	3167	3168	2R9L	Nest	52	29.0	32.2	29.0	16.0	7.9	
12-Aug-08	3169		2R9L	Nest	52	29.6	33.7	28.8	16.1	8.2	
12-Aug-08	3171		2R9L	Nest	52	28.0	32.2	28.6	16.7	8.1	
12-Aug-08	3172	3173	2R9L	Nest	52	30.2	34.5	29.5	16.3	8.7	
12-Aug-08	3174		2R9L	Nest	52	28.5	32.1	28.1	15.8	8.0	
12-Aug-08	3175	3176	2R9L	Nest	52	30.5	33.8	29.3	16.5	8.7	Nuchal Divided
12-Aug-08	3177		2R9L	Nest	52	30.0	32.8	28.9	15.7	7.8	
12-Aug-08	3179		2R9L	Nest	52	29.0	32.5	28.5	15.9	7.9	
12-Aug-08	3180		2R9L	Nest	52	28.3	32.4	29.4	16.7	9.0	
12-Aug-08	3182		2R9L	Nest	52	29.0	33.1	28.3	16.3	8.0	
12-Aug-08	3183	3184	2R9L	Nest	52	29.2	33.7	29.3	16.5	8.6	
12-Aug-08	3185		2R9L	Nest	52	28.3	32.0	29.1	15.4	7.8	
12-Aug-08	3187		2R9L	Nest	52	28.9	32.5	28.1	15.8	7.8	13 Marg.(R)
12-Aug-08	3188		2R9L	Nest	52	29.5	33.0	29.1	16.3	7.7	
12-Aug-08	3190		2R9L	Nest	52	29.3	33.0	29.2	16.8	8.6	Nuchal Divided
12-Aug-08	3191	3192	2R9L	Nest	52	29.3	33.1	29.0	16.4	8.4	
12-Aug-08	3193		2R9L	Nest	52	28.8	32.0	28.8	15.8	8.2	
12-Aug-08	3195		2R9L	Nest	52	30.3	34.4	29.7	15.8	8.1	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
12-Aug-08	3196		2R9L	Nest	52	29.7	32.2	27.9	16.2	8.6	Nuchal Divided
12-Aug-08	3198		2R9L	Nest	52	29.7	33.7	30.0	16.9	7.7	
12-Aug-08	3199	3200	2R9L	Nest	52	27.1	31.5	28.1	15.4	9.4	
12-Aug-08	3201		2R9L	Nest	52	29.5	34.4	28.7	16.4	7.6	Nuchal Divided, 1 small extra vertebral
12-Aug-08	3203		2R9L	Nest	52	26.8	30.5	26.7	15.8	8.7	11 Marg.(R&L), Nuchal Divided
12-Aug-08	3204	3205	2R9L	Nest	52	29.2	33.0	29.8	16.0	8.0	
12-Aug-08	3206		2R9L	Nest	17	29.8	32.5	28.7	15.7	8.7	
12-Aug-08	3207	3208	2R9L	Nest	17	30.1	32.3	29.7	16.3	8.2	
12-Aug-08	3209		2R9L	Nest	17	29.4	31.9	28.3	15.0	7.4	
12-Aug-08	3211		2R9L	Nest	17	29.4	32.2	29.2	15.5	8.0	Nuchal Divided
12-Aug-08	3212	3213	2R9L	Nest	17	29.0	32.4	28.7	15.7	7.6	Nuchal Divided
12-Aug-08	3214		2R9L	Nest	17	29.8	32.8	29.2	16.3	8.0	
12-Aug-08	3215	3216	2R9L	Nest	17	29.6	32.0	27.7	15.7	7.2	
12-Aug-08	3217		2R9L	Nest	17	27.8	29.2	28.1	15.7	7.2	10 Marg.(R), 11 Marg.(L), V5 greatly reduced
12-Aug-08	3219		2R9L	Nest	17	28.8	32.5	29.6	16.1	8.2	
12-Aug-08	3220	3221	2R9L	Nest	17	31.0	33.0	29.0	15.6	8.5	Nuchal Divided, 6Vert.
12-Aug-08	3222		2R9L	Nest	16	26.5	31.5	26.8	15.1	6.5	
12-Aug-08	3224		2R9L	Nest	16	25.9	29.6	27.7	15.6	6.2	
12-Aug-08	3225	3226	2R9L	Nest	16	27.5	31.7	27.3	14.8	6.4	
12-Aug-08	3227		2R9L	Nest	16	26.5	32.2	28.2	14.9	6.6	Nuchal Divided
12-Aug-08	3228	3229	2R9L	Nest	16	27.8	32.1	27.5	15.8	6.7	Nuchal Divided
12-Aug-08	3230		2R9L	Nest	16	25.3	30.7	26.8	15.6	6.2	
12-Aug-08	3231	3232	2R9L	Nest	16	27.1	31.6	26.7	14.9	6.6	
12-Aug-08	3234		2R9L	Nest	16	27.0	31.3	27.7	15.4	6.6	
12-Aug-08	3235		2R9L	Nest	16	26.3	31.1	28.0	15.4	6.7	
12-Aug-08	3236	3237	2R9L	Nest	16	27.9	31.5	27.6	14.8	6.6	Nuchal Divided
12-Aug-08	3238		2R9L	Nest	16	26.1	31.1	27.1	15.0	6.3	
12-Aug-08	3240		2R9L	Nest	16	27.5	32.1	27.6	14.5	6.5	
12-Aug-08	3241	3242	1R2R9L	Nest	69	26.5	29.8	28.1	15.7	7.7	
12-Aug-08	3243		1R2R9L	Nest	69	26.4	29.3	26.6	16.3	7.3	
12-Aug-08	3244	3245	1R2R9L	Nest	69	24.2	26.9	23.4	15.0	5.9	Nuchal Divided
12-Aug-08	3246		1R2R9L	Nest	69	26.3	29.9	27.0	16.3	7.6	
12-Aug-08	3248		1R2R9L	Nest	69	25.9	28.3	25.7	14.9	6.9	
12-Aug-08	3249	3250	1R2R9L	Nest	69	25.1	28.8	25.6	16.0	6.6	
12-Aug-08	3251		1R2R9L	Nest	69	25.5	28.9	25.3	15.7	6.9	Nuchal Divided
12-Aug-08	3252	3253	1R2R9L	Nest	69	26.4	28.1	26.1	15.7	7.5	Nuchal Divided
12-Aug-08	3254		1R2R9L	Nest	69	25.7	28.1	24.6	15.5	6.6	
12-Aug-08	3256		1R2R9L	Nest	69	25.6	28.5	25.7	16.1	6.7	Nuchal Divided
12-Aug-08	3257	3258	2R3R9L	Nest	78	27.0	30.2	26.9	17.3	7.8	
12-Aug-08	3259		2R3R9L	Nest	78	25.3	29.2	26.2	16.3	7.0	
12-Aug-08	3260	3261	2R3R9L	Nest	78	25.7	30.8	27.1	17.1	7.9	
12-Aug-08	3262		2R3R9L	Nest	78	26.3	31.0	27.2	15.7	7.8	
12-Aug-08	3264		2R3R9L	Nest	78	25.0	31.1	25.9	17.2	7.0	
12-Aug-08	3265	3266	2R3R9L	Nest	78	25.5	31.0	27.0	16.5	7.7	
12-Aug-08	3267		2R3R9L	Nest	78	26.5	30.2	27.8	17.7	7.8	6 Vert., V4 is divided
12-Aug-08	3268	3269	2R3R9L	Nest	78	26.0	30.0	26.8	17.5	7.4	6 Vert., V4 is divided
12-Aug-08	3270		2R3R9L	Nest	78	27.0	31.5	27.8	17.0	8.5	anomolous V5
12-Aug-08	3272		2R3R9L	Nest	78	25.7	29.0	25.6	17.5	7.4	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
12-Aug-08	Dead		2R9L	Nest	16	25.0	29.1	27.4	15.0	6.1	Discovered dead inside of ring with other live turtles
13-Aug-08	3274		2R9L	Nest	35	24.5	27.4	24.0	14.5	4.7	
13-Aug-08	3275		2R9L	Nest	13	26.7	30.3	27.1	14.6	6.3	
13-Aug-08	3276	3277	2R9L	Nest	13	27.1	30.7	26.6	14.9	6.7	
13-Aug-08	3278		2R9L	Nest	13	25.5	29.4	26.5	15.5	6.7	
13-Aug-08	3280		2R9L	Nest	13	26.6	30.9	27.3	15.1	6.5	
17-Aug-08	3281	3282	2R8R9L	Nest	94	25.2	29.2	27.2	15.8	7.0	
17-Aug-08	3283		2R8R9L	Nest	94	26.1	30.1	27.1	15.8	7.5	
18-Aug-08	3285		2R8R9L	Nest	94	26.4	29.9	28.1	15.1	7.8	
18-Aug-08	3286	3287	2R8R9L	Nest	94	27.2	30.3	29.1	17.2	9.1	
18-Aug-08	3288		2R11R9L	Nest	50	27.6	32.0	27.4	15.9	7.8	
18-Aug-08	3289	3290	2R11R9L	Nest	50	28.2	32.6	28.2	15.6	7.7	
18-Aug-08	3291		2R9L	Nest	117	24.5	27.1	24.1	15.3	6.2	
18-Aug-08	3293		2R9L	Nest	86	21.0	25.0	21.2	14.9	5.0	
18-Aug-08	3294	3295	2R9L	Nest	86	22.0	26.1	23.2	13.9	5.2	
18-Aug-08	3296		2R9L	Nest	86	22.5	26.8	23.8	14.2	5.3	
18-Aug-08	3298		2R9L	Nest	86	23.0	26.2	23.6	14.2	5.5	
18-Aug-08	3299		2R9R9L	Nest	46	29.4	31.9	27.8	15.8	7.3	
18-Aug-08	3301		2R8R9L	Nest	94	28.3	32.8	29.0	17.6	10.0	
18-Aug-08	3302	3303	2R8R9L	Nest	94	28.3	32.5	28.5	17.4	10.4	
18-Aug-08	3304		2R8R9L	Nest	94	27.5	31.5	29.0	17.3	9.8	
18-Aug-08	3305	3306	2R8R9L	Nest	94	28.0	31.7	28.5	17.1	9.9	
19-Aug-08	3307		2R11R9L	Nest	50	28.6	31.5	27.7	16.5	7.8	
19-Aug-08	3309		2R11R9L	Nest	50	28.5	31.5	28.8	16.2	8.0	
19-Aug-08	3310	3311	2R11R9L	Nest	50	28.4	32.4	29.3	16.5	8.2	
19-Aug-08	3312		2R9R9L	Nest	46	28.8	31.4	27.6	16.0	7.3	
19-Aug-08	3314		2R9R9L	Nest	46	28.1	32.1	29.7	16.0	7.7	
19-Aug-08	3315	3316	2R9R9L	Nest	46	29.4	31.6	29.9	16.1	8.2	
19-Aug-08	3320	3321	2R9R9L	Nest	46	27.5	31.2	28.2	16.0	7.5	
19-Aug-08	3322		2R9R9L	Nest	46	28.5	33.2	29.2	16.5	8.1	Nuchal Divided
19-Aug-08	3323	3324	2R9R9L	Nest	46	27.2	30.1	27.2	15.7	6.9	
19-Aug-08	3325		2R9R9L	Nest	46	29.5	32.6	29.2	15.7	7.4	
19-Aug-08	3327		2R9R9L	Nest	46	29.5	32.5	29.1	15.6	7.8	
19-Aug-08	3328	3329	2R9R9L	Nest	46	28.2	31.5	28.2	16.1	7.4	
19-Aug-08	3330		2R9R9L	Nest	46	26.9	29.5	26.1	15.0	6.4	
19-Aug-08	3331	3332	2R10R9L	Nest	45	28.1	31.5	27.4	16.0	7.8	
19-Aug-08	3333	3334	2R10R9L	Nest	45	27.6	31.3	27.7	16.5	7.5	
19-Aug-08	3335		2R10R9L	Nest	45	27.6	31.2	27.8	15.9	7.1	
19-Aug-08	3337	3338	2R10R9L	Nest	45	27.4	31.8	28.5	14.7	7.4	
19-Aug-08	3339		2R10R9L	Nest	45	27.4	30.7	27.7	15.9	7.5	Nuchal Divided
19-Aug-08	3340		2R10R9L	Nest	45	27.5	30.2	27.7	14.9	6.8	Nuchal Divided
19-Aug-08	3341	3342	2R10R9L	Nest	45	27.7	31.7	27.7	15.8	7.7	Nuchal Divided
19-Aug-08	3343		2R10R9L	Nest	45	28.2	31.4	27.6	15.3	7.1	
19-Aug-08	3345		2R10R9L	Nest	45	29.1	31.7	28.2	15.8	8.0	No Nuchal
19-Aug-08	3346		2R10R9L	Nest	45	29.1	31.7	27.6	15.7	7.2	Nuchal Divided
19-Aug-08	3348		2R10R9L	Nest	45	27.3	31.8	28.8	16.0	7.6	
19-Aug-08	3349	3350	2R10R9L	Nest	45	27.6	31.9	28.0	15.5	7.6	
19-Aug-08	3351		2R10R9L	Nest	45	28.2	31.8	27.7	15.0	7.3	
19-Aug-08	3352	3353	2R10R9L	Nest	45	27.6	30.2	26.5	15.7	7.0	
19-Aug-08	3354		2R10R9L	Nest	45	27.8	31.0	27.2	15.6	7.0	
19-Aug-08	3356		2R10R9L	Nest	45	28.2	31.2	28.0	15.3	7.1	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
20-Aug-08	3359		2R11R9L	Nest	50	28.1	31.3	28.1	16.2	8.1	
20-Aug-08	3361		2R11R9L	Nest	50	27.0	31.1	27.8	16.1	7.4	
20-Aug-08	3362	3363	2R11R9L	Nest	50	26.7	31.3	27.8	15.5	6.9	
20-Aug-08	3364		2R11R9L	Nest	50	27.7	30.5	28.1	16.2	7.3	
20-Aug-08	3365	3366	2R11R9L	Nest	50	28.0	31.7	28.2	16.2	7.5	
20-Aug-08	3367		2R12R9L	Nest	42	27.3	31.6	29.7	17.0	8.4	Nuchal Divided
20-Aug-08	3369		2R12R9L	Nest	42	28.6	31.9	29.4	16.1	8.2	Nuchal Divided
20-Aug-08	3370	3371	2R12R9L	Nest	42	27.8	30.6	28.0	17.3	8.1	Nuchal Divided
20-Aug-08	3372		2R12R9L	Nest	42	28.7	32.0	29.1	17.2	8.2	Nuchal Divided
20-Aug-08	3373	3374	2R12R9L	Nest	42	28.2	32.2	29.6	16.1	8.2	
20-Aug-08	3375		2R12R9L	Nest	42	28.5	32.0	28.0	16.5	8.1	
20-Aug-08	3377		2R12R9L	Nest	42	28.1	31.6	29.0	16.5	8.1	
20-Aug-08	3378		2R12R9L	Nest	42	28.4	32.3	29.8	16.6	8.3	
20-Aug-08	3380		2R12R9L	Nest	42	28.0	31.0	28.5	16.8	7.6	Nuchal Divided
20-Aug-08	3382		2R12R9L	Nest	42	27.7	31.5	30.1	16.7	8.3	
20-Aug-08	3383	3384	2R9L	Nest	42	28.8	33.1	30.1	16.6	8.6	
20-Aug-08	3385		2R9L	Nest	42	28.1	32.1	29.5	18.1	8.6	
20-Aug-08	3386	3387	2R9L	Nest	193	26.4	31.6	28.4	16.7	8.7	
20-Aug-08	3388		2R9L	Nest	122	22.3	26.2	23.4	15.6	6.1	
20-Aug-08	3390		2R9L	Nest	122	24.0	26.0	24.0	16.0	6.0	
20-Aug-08	3391	3392	2R9L	Nest	122	23.6	26.2	24.1	15.3	6.0	
20-Aug-08	3393		2R9L	Nest	117	25.0	29.2	25.8	15.1	6.1	
21-Aug-08	3394	3395	2R9L	Nest	102	26.7	31.2	28.3	16.5	8.6	
21-Aug-08	3396		2R9L	Nest	127	20.3	23.0	19.8	13.2	3.7	
21-Aug-08	3398		2R9L	Nest	127	25.2	28.1	24.5	14.3	5.7	
21-Aug-08	3399		2R9L	Nest	127	24.8	27.5	24.6	15.2	5.5	
21-Aug-08	3401		2R9L	Nest	127	23.0	26.6	24.1	14.2	5.1	
21-Aug-08	3403		2R9L	Nest	127	24.4	27.9	25.0	14.5	5.9	
21-Aug-08	3404		2R9L	Nest	195	27.9	31.8	28.8	16.1	8.5	
21-Aug-08	3406		2R9L	Nest	195	29.1	31.7	28.5	16.8	8.6	
21-Aug-08	3407	3408	2R9L	Nest	127	24.4	26.5	25.1	13.9	5.5	14 Marg.(R), 13 Marg.(L), No Nuchal
22-Aug-08	3409		2R9L	Nest	102	21.6	25.6	22.1	18.0	6.4	Yolk sac still exposed, asymetrical development of shell, died overnight
22-Aug-08	3411		2R9L	Nest	122	25.5	28.6	25.5	15.7	7.6	
22-Aug-08	3412		2R9L	Nest	25	26.5	29.0	26.5	15.0	6.1	
24-Aug-08				Nest	25						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	25						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	25						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	38						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	47						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	47						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	51						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	51						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	51						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	98						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	102						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	142						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	152						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	152						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	152						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	152						Doug Deter, checked nest and released on weekend
24-Aug-08				Nest	152						Doug Deter, checked nest and released on weekend
25-Aug-08	3414		2R9L	Nest	49	28.6	33.1	26.9	16.0	7.3	
25-Aug-08	3415	3416	2R9L	Nest	51	29.9	35.5	30.0	16.5	9.7	
25-Aug-08	3419		2R9L	Nest	130	26.4	29.3	26.6	15.3	7.6	
25-Aug-08	3420		2R9L	Nest	130	28.2	31.4	27.8	16.3	8.8	Nuchal Divided
25-Aug-08	3422		2R9L	Nest	130	27.9	31.5	28.2	16.9	9.1	Nuchal Divided
25-Aug-08	3423	3424	2R9L	Nest	130	25.9	30.0	26.5	15.0	6.8	
25-Aug-08	3426	3427	2R9L	Nest	130	27.7	30.3	28.0	16.0	8.3	Nuchal Divided, 6Vert.
25-Aug-08	3428		2R9L	Nest	130	25.8	29.3	26.7	16.1	7.5	Nuchal Divided
25-Aug-08	3430		2R9L	Nest	130	25.1	29.2	26.3	15.0	6.8	Nuchal Divided
25-Aug-08	3432		2R9L	Nest	130	25.8	28.5	25.8	16.0	7.0	
25-Aug-08	3433		2R9L	Nest	130	25.7	28.7	25.8	15.7	7.1	
25-Aug-08	3434	3435	2R9L	Nest	130	25.2	28.8	26.9	15.5	7.1	Nuchal Divided
25-Aug-08	3438		2R9L	Nest	130	26.6	29.8	27.3	15.8	8.0	
25-Aug-08	3439	3440	2R9L	Nest	130	26.8	30.5	27.5	15.4	7.3	
25-Aug-08	3441		2R9L	Nest	130	26.8	30.2	28.3	16.7	8.6	Nuchal Divided
25-Aug-08	3442	3443	2R9L	Nest	130	28.2	31.1	28.3	16.4	8.8	Nuchal Divided
25-Aug-08	3444		2R9L	Nest	25	26.4	30.3	26.4	14.9	6.1	
25-Aug-08	3446		2R9L	Nest	142	23.6	27.4	24.1	14.8	5.1	
25-Aug-08	3447	3448	2R9L	Nest	47	29.2	33.3	29.2	16.6	8.4	
25-Aug-08	3449		2R9L	Nest	47	29.3	33.9	29.6	16.9	8.8	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
25-Aug-08	3452		2R9L	Nest	47	28.8	33.6	30.0	15.9	8.1	
25-Aug-08	3454		2R9L	Nest	47	29.0	34.4	29.8	16.3	8.8	
25-Aug-08	3455	3456	2R9L	Nest	47	30.0	34.6	30.3	16.9	9.1	
25-Aug-08	3457		2R9L	Nest	47	29.0	34.5	30.6	17.0	8.4	
25-Aug-08	3459		2R1L9L	Nest	127	27.7	31.0	27.0	16.0	8.3	
25-Aug-08	3460		2R1L9L	Nest	127	27.0	31.0	27.2	15.7	8.3	Abnormal development of Vert. 2&3
25-Aug-08	3462		2R1L9L	Nest	127	26.3	30.0	26.9	15.8	8.0	
25-Aug-08	3463	3464	2R1L9L	Nest	127	25.5	29.1	26.2	15.2	7.4	
25-Aug-08	3465		2R1L9L	Nest	127	25.5	29.1	26.1	15.5	7.3	
25-Aug-08	3467		2R1L9L	Nest	127	23.8	27.0	25.5	14.9	4.7	Nuchal Divided, 5th Vert. greatly reduced
25-Aug-08	3468		2R1L9L	Nest	127	27.3	30.7	27.0	15.7	8.1	
25-Aug-08	3470		2R1L9L	Nest	127	26.0	30.8	27.8	16.1	8.4	
25-Aug-08	3471	3472	2R1L9L	Nest	127	22.0	26.1	23.2	15.6	5.7	Nuchal Divided
25-Aug-08	3473		2R1L9L	Nest	127	28.3	30.8	27.2	16.6	8.8	
25-Aug-08	3475		2R9L	Nest	98	25.2	29.8	26.2	16.0	6.2	
25-Aug-08	3476		2R9L	Nest	98	26.8	30.2	28.8	15.6	6.7	
25-Aug-08	3478		2R9L	Nest	8	28.9	32.7	28.3	15.7	7.9	
26-Aug-08	3479	3480	2R2L9L	Nest	99	29.0	33.5	28.6	16.8	8.4	
26-Aug-08	3481		2R2L9L		99	28.5	32.6	28.7	16.3	7.8	
26-Aug-08	3483		2R2L9L	Nest	99	28.2	32.4	28.6	15.5	7.8	Nuchal Divided
26-Aug-08	3484	3485	2R2L9L	Nest	99	27.3	32.1	27.7	16.0	7.5	Nuchal Divided
26-Aug-08	3486		2R2L9L	Nest	99	29.6	33.7	29.9	16.7	9.0	
26-Aug-08	3487	3488	2R2L9L	Nest	99	28.3	33.0	29.1	16.1	8.3	
26-Aug-08	3489		2R2L9L	Nest	99	27.3	32.9	28.7	16.4	8.3	Nuchal Divided
26-Aug-08	3491		2R2L9L	Nest	99	28.1	32.6	29.0	15.9	8.0	
26-Aug-08	3492	3493	2R2L9L	Nest	99	29.2	33.4	30.0	16.3	8.8	
26-Aug-08	3494		2R2L9L	Nest	99	29.1	32.5	28.2	16.4	8.0	
26-Aug-08	3495	3496	2R2L9L	Nest	99	28.8	33.2	29.5	16.9	8.2	
26-Aug-08	3497		2R9L	Nest	99	29	33	29.5	17	8.3	
26-Aug-08	3499		2R9L	Nest	99	27.7	32.9	29.1	16.7	8.1	
26-Aug-08	3500	3501	2R9L	Nest	88	25.6	29.6	24.7	14.5	5.4	6 Vert., V2 is divided, 13 Marg. (L&R)
26-Aug-08	3502		2R9L	Nest	88	26.1	30.0	25.7	14.6	6.1	
26-Aug-08	3503	3504	2R9L	Nest	88	26.0	30.3	26.6	15.4	6.4	
26-Aug-08	3505		2R9L	Nest	88	25.9	29.3	26.0	13.9	5.4	
26-Aug-08	3507		2R9L	Nest	88	26.6	29.8	26.8	15.0	6.2	
26-Aug-08	3508	3509	2R9L	Nest	88	24.8	29.2	26.6	14.2	5.7	
26-Aug-08	3510		2R9L	Nest	88	25.5	30.5	27.4	14.3	6.2	Nuchal Divided
26-Aug-08	3512		2R9L	Nest	88	26.3	29.9	24.9	15.0	6.1	
26-Aug-08	3513	3514	2R9L	Nest	88	24.2	28.9	25.1	14.6	5.5	6 Vert, Nuchal partially divided, V4 divided
26-Aug-08	3515		2R9L	Nest	88	26.5	30.0	26.0	14.9	6.0	
26-Aug-08	3518		2R9L	Nest	88	26.4	30.6	27.5	14.8	6.5	
26-Aug-08	3520		2R9L	Nest	88	25.8	29.2	26.1	14.6	5.9	
27-Aug-08	3352		2R9L	Nest	8	28.0	32.4	28.3	16.3	8.3	
27-Aug-08	3521	3522	2R3L9L	Nest	82	28.7	33.0	29.7	16.5	8.3	
27-Aug-08	3523		2R3L9L	Nest	82	27.6	32.4	29.3	15.8	7.9	
27-Aug-08	3524	3524	2R3L9L	Nest	82	28.5	32.8	29.7	16.5	8.5	
27-Aug-08	3526		2R3L9L	Nest	82	29.7	33.3	29.5	16.7	8.6	Nuchal Divided

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
27-Aug-08	3528		2R3L9L	Nest	82	29.8	33.8	30.2	17.2	9.1	Nuchal Divided
27-Aug-08	3531		2R3L9L	Nest	82	29.1	33.7	30.3	17.0	9.2	
27-Aug-08	3532	3533	2R3L9L	Nest	82	30.0	33.5	29.9	16.4	8.5	
27-Aug-08	3533	3534	2R9L	Nest	51	28.1	33.3	29.1	15.5	7.6	
27-Aug-08	3534		2R3L9L	Nest	82	28.0	32.9	29.8	16.9	8.9	
27-Aug-08	3536		2R3L9L	Nest	82	28.8	33.3	29.9	17.0	8.9	Nuchal Divided
27-Aug-08	3537	3538	2R3L9L	Nest	82	28.8	34.4	30.9	16.8	9.4	
27-Aug-08	3539		2R9L	Nest	82	28.8	33.0	29.0	16.5	8.1	
27-Aug-08	3540	3541	2R9L	Nest	82	28.3	33.0	29.8	16.4	8.5	Nuchal Divided
27-Aug-08	3542		2R9L	Nest	82	29.0	35.6	29.5	16.7	8.4	
27-Aug-08	3544		2R9L	Nest	82	27.8	32.6	29.7	16.7	8.5	
27-Aug-08	3545	3546	2R9L	Nest	82	30.0	34.0	29.4	16.7	8.6	
27-Aug-08	3547		2R9L	Nest	82	28.1	32.8	29.0	16.3	8.3	
27-Aug-08	3548	3549	2R9L	Nest	49	25.1	29.3	27.2	16.1	7.3	
27-Aug-08	3550		2R9L	Nest	8	28.0	32.8	28.2	16.3	8.1	
28-Aug-08	3555		2R9L	Nest	155	24.3	26.5	24.2	15.9	6.1	
28-Aug-08	3556	3557	2R9L	Nest	198	26.3	29.6	27.0	15.4	8.0	
28-Aug-08	3558		2R9L	Nest	49	26.3	29.6	23.9	16.4	7.9	
28-Aug-08	3560		2R9L	Nest	49	27.7	31.0	27.5	16.3	7.7	
28-Aug-08	3561	3562	2R9L	Nest	49	27.0	29.8	27.7	15.3	7.4	
29-Aug-08	3563		2R8R9L	Nest	77	27.6	30.6	27.7	16.3	8.5	
29-Aug-08	3565		2R8R9L	Nest	77	27.3	31.0	27.1	16.1	7.5	
29-Aug-08	3566	3567	2R8R9L	Nest	77	26.1	30.2	27.3	16.6	7.7	
29-Aug-08	3568		2R8R9L	Nest	77	25.8	30.0	26.9	16.9	7.9	
29-Aug-08	3570		2R8R9L	Nest	77	25.8	29.1	25.0	16.6	7.0	
29-Aug-08	3571	3572	2R8R9L	Nest	77	27.5	31.1	27.5	16.8	8.4	
29-Aug-08	3573		2R8R9L	Nest	77	25.3	28.8	24.7	15.6	6.9	
29-Aug-08	3574	3575	2R8R9L	Nest	77	26.8	30.0	26.8	16.2	7.6	
29-Aug-08	3576		2R8R9L	Nest	77	25.8	29.3	25.6	15.8	7.2	
29-Aug-08	3578		2R8R9L	Nest	77	27.2	29.6	27.2	16.1	7.8	
29-Aug-08	3579		2R9L	Nest	77	28.7	32.2	29.1	16.7	8.9	
29-Aug-08	3581		2R9L	Nest	77	29.6	33.2	28.5	16.1	8.6	Nuchal Divided
29-Aug-08	3582	3583	2R9L	Nest	77	29.3	33.4	29.5	16.5	9.0	
1-Sep-08	3584		2R9L	Nest	55	25.8	29.0	25.5	15.3	6.4	
1-Sep-08	3586		2R9L	Nest	55	25.9	30.0	26.6	15.0	6.5	
1-Sep-08	3587	3588	2R9L	Nest	55	26.4	28.9	25.7	15.0	6.2	
2-Sep-08	3589		2R8L9L	Nest	128	28.8	31.7	28.5	16.3	8.7	
2-Sep-08	3590	3591	2R8L9L	Nest	128	28.5	32.3	27.6	15.8	8.2	
2-Sep-08	3592		2R8L9L	Nest	128	29.6	34.0	29.8	16.6	9.7	
2-Sep-08	3594		2R8L9L	Nest	128	27.1	31.3	27.2	15.6	7.4	
2-Sep-08	3595	3596	2R8L9L	Nest	128	29.3	32.3	29.9	16.3	9.0	Nuchal Divided
2-Sep-08	3597		2R8L9L	Nest	128	26.3	29.4	27.4	15.3	7.2	
2-Sep-08	3598	3599	2R8L9L	Nest	128	26.6	29.1	26.7	14.6	6.8	Nuchal Divided
2-Sep-08	3600		2R8L9L	Nest	128	28.3	32.1	28.4	16.5	8.8	Nuchal Divided
2-Sep-08	3602		2R8L9L	Nest	128	29.1	33.0	28.9	16.6	9.3	Nuchal Divided
2-Sep-08	3603		2R8L9L	Nest	128	26.6	30.0	26.8	15.4	7.2	
2-Sep-08	3605		2R9L	Nest	128	30.4	32.1	29.5	16.4	9.7	
2-Sep-08	3606	3607	2R9L	Nest	128	26.5	30.2	26.5	15.1	7.0	
2-Sep-08	3608		2R9L11L	Nest	149	28.3	33.3	30.2	16.3	9.8	Nuchal Divided
2-Sep-08	3610		2R9L11L	Nest	149	28.0	32.6	30.1	17.4	9.5	Nuchal Divided
2-Sep-08	3611	3612	2R9L11L	Nest	149	28.5	32.0	29.6	17.1	9.6	Nuchal Divided
2-Sep-08	3613		2R9L11L	Nest	149	29.1	32.8	29.2	17.3	9.6	Nuchal Divided
2-Sep-08	3615		2R9L11L	Nest	149	27.5	32.2	28.8	16.4	9.5	Nuchal Divided

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
2-Sep-08	3616		2R9L11L	Nest	149	28.3	33.0	29.8	17.1	9.9	
2-Sep-08	3618		2R9L11L	Nest	149	26.9	31.7	28.0	16.4	8.6	
2-Sep-08	3619	3620	2R9L11L	Nest	149	27.6	31.8	28.8	16.5	8.9	
2-Sep-08	3621		2R9L11L	Nest	149	28.6	33.0	29.2	16.6	9.5	Nuchal Divided
2-Sep-08	3622	3623	2R9L11L	Nest	149	29.4	33.4	30.6	17.2	10.3	Nuchal Divided
2-Sep-08	3624		2R9L	Nest	149	28.5	33.1	30.2	17.4	9.7	
3-Sep-08	3626		2R9L	Nest	169	26.2	31.1	27.3	15.0	6.0	
7-Sep-08	3627		2R9L12L	Nest	101	29.2	31.5	27.7	15.8	7.8	
7-Sep-08	3629		2R9L12L	Nest	101	27.7	32.0	29.0	16.4	8.2	
7-Sep-08	3630	3631	2R9L12L	Nest	101	28.9	32.0	28.6	16.6	8.3	
7-Sep-08	3632		2R9L12L	Nest	101	29.0	32.1	29.5	16.7	8.5	
7-Sep-08	3634		2R9L12L	Nest	101	28.6	33.2	28.7	16.3	8.6	
7-Sep-08	3635	3636	2R9L12L	Nest	101	28.6	31.0	27.8	15.6	7.7	6 Vert., 13 Marg(R&L)
7-Sep-08	3637		2R9L12L	Nest	101	28.9	31.3	29.1	15.6	8.0	6 Vert.
7-Sep-08	3638	3639	2R9L12L	Nest	101	28.7	32.3	29.4	15.1	7.9	
7-Sep-08	3640		2R9L12L	Nest	101	28.9	32.4	28.9	16.6	8.6	
7-Sep-08	3642		2R9L12L	Nest	101	28.8	32.3	28.9	16.3	8.6	
7-Sep-08	3643	3644	2R9L	Nest	101	27.5	31.3	27.1	16.2	7.8	6 Vert.
7-Sep-08	3645		2R9L	Nest	101	29.5	32.5	29.2	16.0	8.3	
7-Sep-08	3646	3647	2R9L	Nest	101	22.8	28.2	26.8	14.5	7.1	Plasteron underdeveloped(short&skewed right), 6 Vert., 11Marg.(R), 13 Marg.(L)
7-Sep-08	3648		2R9L	Nest	101	29.4	31.4	28.6	15.7	7.8	
7-Sep-08	3650		2R9L	Nest	54/199	23.7	28.0	15.7	13.7	5.5	
7-Sep-08	3651	3652	2R9L	Nest	54/199	28.5	33.4	29.6	17.1	9.5	
7-Sep-08	3653		2R9L	Nest	54/199	24.7	27.9	25.1	15.0	6.0	13 Marg.(R)
7-Sep-08	3654	3655	2R9L	Nest	54/199	29.1	32.2	29.1	16.9	8.2	
7-Sep-08	3656		2R9L	Nest	54/199	29.1	33.2	29.9	16.0	9.1	Nuchal Divided
7-Sep-08	3658		2R9L	Nest	54/199	29.3	33.2	29.1	16.9	8.8	Nuchal Divided
7-Sep-08	3659	3660	2R9L	Nest	54/199	28.5	33.5	29.5	16.7	9.0	Nuchal Divided
7-Sep-08	3661		2R9L	Nest	54/199	24.5	28.6	24.3	14.1	5.8	
7-Sep-08	3663		2R9L	Nest	54/199	29.0	32.9	28.6	16.7	8.4	
7-Sep-08	3664	3665	2R9L	Nest	54/199	24.8	28.9	25.8	14.1	5.8	
7-Sep-08	3666		2R9L	Nest	54/199	24.5	28.7	25.7	14.2	6.0	
7-Sep-08	3667	3668	2R9L	Nest	54/199	29.6	33.0	28.9	16.7	8.3	13 Marg.(R&L)
7-Sep-08	3669		2R9L	Nest	54/199	25.2	29.0	15.7	14.3	5.7	
7-Sep-08	3671		2R9L	Nest	54/199	28.2	31.8	29.0	15.5	8.1	
7-Sep-08	3672	3673	2R9L	Nest	54/199	24.6	29.1	26.1	14.5	5.8	
7-Sep-08	3674		2R9L	Nest	54/199	27.8	32.3	29.9	16.3	8.4	
7-Sep-08	3675	3676	2R9L	Nest	54/199	28.9	31.8	29.0	16.5	8.2	Nuchal Divided
7-Sep-08	3677	3678	2R9L	Nest	54/199	25.3	28.7	25.6	14.4	6.2	11 Marg.(R&L)
7-Sep-08	3679		2R9L	Nest	68	27.3	31.9	27.0	15.8	7.2	13 Marg.(R)
7-Sep-08	3680	3681	2R9L	Nest	68	26.4	30.4	26.6	15.3	6.8	
7-Sep-08	3682		2R9L	Nest	68	26.4	30.5	27.0	15.1	7.0	
7-Sep-08	3684		2R9L	Nest	68	27.1	31.7	27.3	16.6	7.3	
7-Sep-08	3685	3686	1R2R9L	Nest	68	28.5	32.2	28.0	15.6	8.1	
7-Sep-08	3687		1R2R9L	Nest	68	25.9	30.5	27.1	15.7	7.1	
7-Sep-08	3688	3689	1R2R9L	Nest	68	27.1	31.4	26.6	15.3	6.9	Nuchal Divided
7-Sep-08	3690		1R2R9L	Nest	68	27.1	31.8	27.7	15.2	7.2	
7-Sep-08	3692		1R2R9L	Nest	68	27.0	31.5	27.8	16.1	7.5	
7-Sep-08	3693	3694	1R2R9L	Nest	68	28.0	31.4	27.8	15.6	7.4	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	3695		1R2R9L	Nest	68	26.3	31.4	28.1	15.3	7.2	
7-Sep-08	3696	3697	1R2R9L	Nest	68	25.7	30.4	26.8	15.2	6.6	Nuchal Divided
7-Sep-08	3698		1R2R9L	Nest	68	27.5	30.7	27.4	15.5	7.3	V5 extremly reduced in size
7-Sep-08	3700		1R2R9L	Nest	68	27.2	31.6	26.2	15.8	7.3	
7-Sep-08	3701	3702	2R9L	Nest	138	30.3	32.9	28.9	16.3	8.8	4 Vert.
7-Sep-08	3703		2R9L	Nest	138	28.9	33.7	29.6	16.7	9.1	
7-Sep-08	3705		2R9L	Nest	138	29.7	32.9	29.6	16.1	8.7	6 Vert.
7-Sep-08	3706	3707	2R9L	Nest	138	28.4	31.2	28.1	15.8	7.3	
7-Sep-08	3708		2R9L	Nest	138	29.4	33.6	29.5	16.1	9.1	
7-Sep-08	3709	3710	2R9L	Nest	138	30.6	33.9	30.2	17.1	9.8	Nuchal Divided
7-Sep-08	3711		2R9L	Nest	138	29.8	32.5	28.9	16.6	8.7	
7-Sep-08	3714	3715	2R9L	Nest	29	26.4	31.0	27.5	15.5	6.8	
7-Sep-08	3716		2R9L	Nest	29	27.3	31.1	26.2	15.5	7.0	
7-Sep-08	3718		2R9L	Nest	29	26.7	30.3	26.5	15.0	6.6	
7-Sep-08	3719	3720	2R9L	Nest	29	27.2	31.3	27.0	15.3	7.0	
7-Sep-08	3721		2R9L	Nest	29	26.5	30.6	26.4	15.4	6.9	
7-Sep-08	3722	3723	2R9L	Nest	29	26.3	30.5	25.8	15.4	6.7	
7-Sep-08	3724		2R9L	Nest	29	26.3	30.7	26.8	15.3	6.9	
7-Sep-08	3726		2R9L	Nest	29	26.5	31.3	26.2	15.1	6.9	
7-Sep-08	3727	3728	2R9L	Nest	29	24.9	29.2	25.3	14.4	5.9	
7-Sep-08	3729		2R9L	Nest	29	25.2	30.2	26.4	15.6	7.0	
7-Sep-08	3732		2R9L	Nest	29	25.8	31.3	27.0	15.3	6.9	
7-Sep-08	3734		2R9L	Nest	152	26.3	29.6	27.7	16.5	7.8	
7-Sep-08	3735	3736	2R9L	Nest	152	30.3	34.9	29.5	16.8	10.0	
7-Sep-08	3737		2R9L	Nest	152	30.4	32.6	28.2	16.7	8.6	
7-Sep-08	3738	3739	2R9L	Nest	152	26.8	31.3	28.0	15.1	7.9	
7-Sep-08	3740	3741	2R9L	Nest	152	29.7	33.3	28.1	17.1	9.3	
7-Sep-08	3742		2R9L	Nest	152	27.4	31.4	27.8	16.3	7.8	Nuchal Divided, 7 Vert.
7-Sep-08	3743	3744	2R9L	Nest	152	29.9	33.7	29.2	15.8	9.2	
7-Sep-08	3745		2R9L	Nest	152	27.0	31.4	28.3	16.9	8.1	
7-Sep-08	3747		2R9L	Nest	152	27.0	30.3	26.6	15.6	7.3	
7-Sep-08	3748		2R9L	Nest	37	29.5	32.1	27.1	16.1	8.2	7 Vert.
7-Sep-08	3750		2R9L	Nest	37	28.3	32.2	28.0	16.1	8.3	
7-Sep-08	3751	3752	2R9L	Nest	37	26.1	30.3	26.8	16.1	7.8	
7-Sep-08	3753		2R9L	Nest	37	28.4	32.6	28.3	15.8	8.0	
7-Sep-08	3755		2R9L	Nest	37	29.4	33.4	28.4	16.5	8.2	
7-Sep-08	3756	3757	2R9L	Nest	37	28.7	32.9	28.9	16.1	8.2	
7-Sep-08	3758		2R9L	Nest	164	26.2	30.4	26.1	15.1	6.9	
7-Sep-08	3759	3760	2R9L	Nest	132	31.5	32.6	30.1	16.9	9.0	6 Vert.
7-Sep-08	3761		2R9L	Nest	132	29.4	31.4	28.8	16.6	8.6	Nuchal Divided
7-Sep-08	3764	3765	2R9L	Nest	132	31.0	32.2	29.1	17.1	8.8	
7-Sep-08	3766		2R9L	Nest	132	28.5	30.7	27.4	15.7	7.3	
7-Sep-08	3768		2R9L	Nest	132	27.2	29.5	27.3	15.7	6.9	
7-Sep-08	3769		2R9L	Nest	132	31.5	33.4	29.4	17.3	9.5	
7-Sep-08	3771		2R9L	Nest	132	27.1	29.4	27.6	15.2	6.8	6 Vert/
7-Sep-08	3772	3773	2R9L	Nest	132	27.5	30.6	28.3	15.4	7.6	
7-Sep-08	3774		2R9L	Nest	132	27.6	30.4	27.6	15.6	7.4	
7-Sep-08	3776		2R9L	Nest	132	29.1	28.3	29.2	16.2	8.0	
7-Sep-08	3777		2R9L	Nest	132	29.6	31.5	28.6	17.2	8.2	
7-Sep-08	3779		2R9L	Nest	132	28.2	31.0	28.3	15.9	7.7	
7-Sep-08	3781		2R9L	Nest	132	28.9	30.9	28.7	16.3	8.1	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	3782		2R9L	Nest	7	25.6	29.9	26.8	15.3	6.9	
7-Sep-08	3784		2R9L	Nest	7	26.7	30.9	26.4	14.6	7.1	
7-Sep-08	3785	3786	2R9L	Nest	7	24.8	28.0	24.2	14.2	5.8	
7-Sep-08	3787		2R9L	Nest	7	26.5	28.6	24.8	15.1	7.0	
7-Sep-08	3788	3789	2R9L	Nest	7	26.6	30.0	27.4	14.9	7.0	
7-Sep-08	3790		2R9L	Nest	7	25.7	29.0	24.9	15.7	6.7	
7-Sep-08	3792		2R9L	Nest	7	26.5	29.8	26.2	15.3	7.0	
7-Sep-08	3793	3794	2R9L	Nest	7	26.7	29.8	25.7	14.8	6.8	
7-Sep-08	3795		2R9L	Nest	7	27.7	30.5	27.2	15.6	7.1	
7-Sep-08	3797		2R9L	Nest	114	29.2	34.1	29.6	16.5	9.2	
7-Sep-08	3798	3799	2R9L	Nest	114	30.2	33.5	29.7	16.5	8.9	6 Vert.
7-Sep-08	3800		2R9L	Nest	114	26.4	30.3	26.1	14.8	6.2	
7-Sep-08	3801	3802	2R9L	Nest	114	29.4	33.2	29.0	16.2	8.5	
7-Sep-08	3803		2R9L	Nest	114	25.9	29.8	25.7	14.0	5.5	
7-Sep-08	3805		2R9L	Nest	114	27.4	32.3	28.3	14.5	7.2	
7-Sep-08	3806	3807	2R9L	Nest	114	28.1	30.6	28.5	16.2	7.8	
7-Sep-08	3808		2R9L	Nest	114	28.5	32.2	28.2	15.7	7.6	
7-Sep-08	3809	3810	2R9L	Nest	23	28.5	33.5	28.7	16.3	8.5	
7-Sep-08	3811		2R9L	Nest	126	28.5	30.8	26.5	14.8	6.5	
7-Sep-08	3813		2R9L	Nest	126	26.0	29.1	25.1	14.1	6.3	
7-Sep-08	3814	3815	2R9L	Nest	126	27.4	31.0	26.2	14.6	7.0	
7-Sep-08	3816		2R9L	Nest	126	26.7	30.7	26.1	14.1	6.4	
7-Sep-08	3818		2R9L	Nest	126	27.5	30.6	26.4	14.3	6.3	
7-Sep-08	3819		2R9L	Nest	126	20.4	25.6	19.7	15.5	5.1	
7-Sep-08	3821		2R9L	Nest	126	26.5	30.6	25.7	14.3	6.1	
7-Sep-08	3822	3823	2R9L	Nest	126	26.0	30.2	25.9	15.1	6.7	
7-Sep-08	3824		2R9L	Nest	126	27.8	27.0	23.7	14.0	6.0	
7-Sep-08	3826		2R8L	Nest	30	26.6	27.4	27.0	14.8	6.8	
7-Sep-08	3827	3828	2R8L	Nest	30	27.7	29.7	28.2	15.0	7.6	
7-Sep-08	3829		2R8L	Nest	30	27.4	30.1	28.5	15.7	7.7	
7-Sep-08	3830	3831	2R8L	Nest	30	27.4	30.2	27.6	15.4	7.7	
7-Sep-08	3832		2R8L	Nest	30	28.3	30.9	28.1	14.8	7.7	
7-Sep-08	3834		2R8L	Nest	30	26.9	29.3	26.1	14.8	6.9	
7-Sep-08	3835	3836	2R8L	Nest	30	28.2	31.3	27.2	15.8	7.9	
7-Sep-08	3837		2R8L	Nest	30	27.4	30.7	28.6	15.6	7.9	
7-Sep-08	3839		2R8L	Nest	30	28.4	31.6	27.9	15.3	7.8	
7-Sep-08	3840		2R8L	Nest	30	27.0	30.1	27.8	16.2	7.5	
7-Sep-08	3842		2R9L	Nest	71/115	27.3	30.7	27.3	15.7	7.2	
7-Sep-08	3843	3844	2R9L	Nest	71/115	28.0	30.6	26.9	16.1	7.6	13 Marg.(R)
7-Sep-08	3845		2R9L	Nest	71/115	28.1	31.6	27.1	16.1	7.8	
7-Sep-08	3846	3847	2R9L	Nest	71/115	26.1	29.4	27.1	16.3	7.0	
7-Sep-08	3848	3849	2R9L	Nest	71/115	26.9	24.2	27.1	15.8	7.7	Back of Carapace underdeveloped, No tail, No 9R
7-Sep-08	3850		2R9L	Nest	71/115	27.2	30.0	26.8	15.9	7.6	Nuchal Divided
7-Sep-08	3851	3852	2R9L	Nest	71/115	26.4	30.3	26.8	15.9	7.3	
7-Sep-08	3853		2R9L	Nest	71/115	27.0	31.3	27.5	15.7	7.4	
7-Sep-08	3855		2R9L	Nest	71/115	27.2	31.1	27.2	15.4	7.6	
7-Sep-08	3856	3857	2R9L	Nest	71/115	27.2	31.7	27.2	16.4	7.8	
7-Sep-08	3858		2R9L	Nest	71/115	27.2	31.8	27.6	15.7	7.3	
7-Sep-08	3859	3860	2R9L	Nest	71/115	29.1	31.7	28.5	16.8	8.5	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	3861		2R9L	Nest	71/115	25.1	29.9	27.4	15.0	7.1	6 Vert., 2nd & 3rd Marg.(R) divided, plastaron asymetrical
7-Sep-08	3863		2R9L	Nest	71/115	27.6	31.9	28.2	15.1	7.5	13 Marg.(R)
7-Sep-08	3864	3865	2R9L	Nest	71/115	27.3	31.8	28.0	15.4	7.4	
7-Sep-08	3866		2R9L	Nest	71/115	27.5	29.4	26.9	15.7	7.2	13 Marg.(R), 2R greatly reduced in size
7-Sep-08	3867	3868	2R9L	Nest	71/115	26.7	29.1	26.2	15.2	7.1	13 Marg.(R&L), 2R greatly reduced in size
7-Sep-08	3869		2R9L	Nest	71/115	28.2	32.1	27.3	16.5	7.7	
7-Sep-08	3871		2R9L	Nest	71/115	26.9	31.1	27.6	15.9	7.4	
7-Sep-08	3872	3873	2R9L	Nest	71/115	27.3	31.8	27.6	16.0	7.7	
7-Sep-08	3874		2R3R9L	Nest	11	27.5	31.4	27.6	16.0	7.1	
7-Sep-08	3875	3876	2R3R9L	Nest	11	28.3	32.7	27.2	15.1	7.3	
7-Sep-08	3877		2R3R9L	Nest	11	29.1	32.0	27.2	15.8	7.6	
7-Sep-08	3879		2R3R9L	Nest	11	28.7	31.7	27.3	16.2	7.9	
7-Sep-08	3880	3881	2R3R9L	Nest	11	27.6	29.8	27.0	15.7	7.3	Nuchal Divided
7-Sep-08	3882		2R3R9L	Nest	11	28.0	30.7	26.7	15.9	7.4	
7-Sep-08	3883	3884	2R3R9L	Nest	11	27.3	31.5	27.8	15.0	7.3	
7-Sep-08	3885		2R3R9L	Nest	11	27.2	32.3	28.2	15.9	7.7	
7-Sep-08	3887		2R3R9L	Nest	11	28.2	32.3	27.6	16.1	7.9	
7-Sep-08	3888	3889	2R3R9L	Nest	11	28.3	30.4	27.9	16.1	7.7	
7-Sep-08	3890		2R9L	Nest	11	25.0	29.0	24.8	14.5	6.0	
7-Sep-08	3895		2R9L	Nest	200	28.4	31.4	28.5	16.0	7.9	Found along fence near cell 5
7-Sep-08	3896	3897	2R10L	Nest	124	28.6	32.2	29.0	17.7	8.8	
7-Sep-08	3898		2R10L	Nest	124	29.1	32.2	28.7	17.0	8.3	
7-Sep-08	3899	3900	2R10L	Nest	124	26.6	30.8	27.3	16.1	7.1	5 Cost.(R)
7-Sep-08	3901		2R10L	Nest	124	28.0	31.5	28.7	17.1	8.3	
7-Sep-08	3903		2R10L	Nest	124	29.8	32.7	30.1	16.8	9.3	
7-Sep-08	3904	3905	2R10L	Nest	124	27.7	31.3	28.2	15.6	8.2	
7-Sep-08	3906		2R10L	Nest	124	26.7	29.4	26.9	16.0	8.8	
7-Sep-08	3907	3908	2R10L	Nest	124	26.6	30.9	27.3	14.5	7.5	
7-Sep-08	3909		2R10L	Nest	124	28.7	31.3	28.6	16.2	8.3	
7-Sep-08	3911		2R10L	Nest	124	29.5	33.0	29.5	17.2	9.6	
7-Sep-08	3912	3913	2R9L	Nest	124	26.2	28.1	25.4	14.5	6.1	Nuchal Divided
7-Sep-08	3914		2R9L	Nest	124	27.9	29.9	27.5	15.7	7.7	
7-Sep-08	3915	3916	2R9L	Nest	124	25.1	29.1	26.2	15.7	6.4	
7-Sep-08	3917		2R9L	Nest	124	24.8	27.9	25.3	14.7	6.4	
7-Sep-08	3919		2R9L	Nest	134/201	29.3	31.6	29.2	14.3	7.6	
7-Sep-08	3920	3921	2R9L	Nest	134/201	30.2	32.0	28.5	16.1	8.6	
7-Sep-08	3922		2R9L	Nest	134/201	28.2	31.2	28.1	17.2	7.9	
7-Sep-08	3924		2R9L	Nest	134/201	28.1	31.8	28.3	15.4	7.5	
7-Sep-08	3925		2R9L	Nest	134/201	29.9	32.7	28.4	16.3	7.8	
7-Sep-08	3927		2R9L	Nest	134/201	29.9	32.0	29.1	17.1	8.6	Nuchal Divided
7-Sep-08	3928	3929	2R9L	Nest	134/201	30.2	32.7	29.2	15.7	8.5	6 Vert.
7-Sep-08	3930		2R9L	Nest	134/201	28.2	30.5	27.2	15.8	7.3	
7-Sep-08	3931	3932	2R9L	Nest	134/201	28.2	31.5	28.0	16.5	7.6	Nuchal Divided
7-Sep-08	3933	3934	2R9L	Nest	134/201	29.7	30.7	28.7	17.3	8.5	13 Marg.(R&L)
7-Sep-08	3935		2R9L	Nest	134/201	27.9	30.7	27.9	16.0	7.7	Nuchal Divided
7-Sep-08	3936	3937	2R9L	Nest	134/201	28.1	30.8	26.4	15.3	7.1	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	3938		2R9L	Nest	134/201	30.3	33.6	29.0	16.8	9.0	5 Cost.(R)
7-Sep-08	3940		2R9L	Nest	134/201	29.0	31.2	27.4	17.2	7.4	
7-Sep-08	3941	3942	2R9L	Nest	134/201	30.0	33.5	29.7	16.5	8.8	
7-Sep-08	3943		2R9L	Nest	134/201	28.9	32.2	29.0	16.3	8.4	Nuchal Divided
7-Sep-08	3944	3945	2R9L	Nest	134/201	28.9	31.5	28.1	16.2	7.9	
7-Sep-08	3946		2R9L	Nest	134/201	27.9	31.1	27.0	15.0	7.2	
7-Sep-08	3948		2R9L	Nest	134/201	28.2	30.5	26.6	15.0	6.9	
7-Sep-08	3949	3950	2R9L	Nest	134/201	28.1	30.7	27.8	16.1	7.8	Nuchal Divided
7-Sep-08	3951		2R9L	Nest	134/201	29.0	30.8	27.4	16.3	7.9	Nuchal Divided
7-Sep-08	3953		2R9L	Nest	134/201	25.7	30.0	27.2	15.6	6.8	
7-Sep-08	3954	3955	2R9L	Nest	134/201	28.0	30.6	26.1	16.9	6.8	Nuchal Divided
7-Sep-08	3956		2R9L	Nest	134/201	27.7	30.5	27.2	15.4	6.7	
7-Sep-08	3957	3958	2R9L	Nest	134/201	26.8	29.8	26.3	14.7	6.5	
7-Sep-08	3959		2R9L	Nest	134/201	28.2	31.2	28.0	14.5	7.2	
7-Sep-08	3961		2R11L	Nest	108	28.2	30.3	27.4	15.3	7.2	
7-Sep-08	3962	3963	2R11L	Nest	108	26.2	28.1	27.9	15.4	6.3	
7-Sep-08	3964		2R11L	Nest	108	28.8	29.0	26.9	15.1	6.2	
7-Sep-08	3966		2R9L	Nest	108	25.5	29.2	26.4	15.8	6.8	11 Marg.(L)
7-Sep-08	3967		2R9L	Nest	108	26.1	28.8	26.9	14.2	5.7	13 Marg.(R&L)
7-Sep-08	3969		2R9L	Nest	108	28.0	29.8	28.8	15.3	7.2	
7-Sep-08	3970	3971	2R9L	Nest	108	28.2	30.4	27.7	14.7	7.1	
7-Sep-08	3972		2R9L	Nest	108	28.8	30.2	26.7	15.7	6.8	
7-Sep-08	3974		2R11L	Nest	62	28.5	32.2	27.1	15.0	7.3	Nuchal Divided
7-Sep-08	3975	3976	2R11L	Nest	62	30.5	33.4	29.9	16.2	8.4	
7-Sep-08	3977		2R11L	Nest	62	29.5	32.5	29.1	15.5	7.9	
7-Sep-08	3978	3979	2R11L	Nest	62	28.2	32.1	27.7	15.5	7.3	
7-Sep-08	3980		2R11L	Nest	62	28	32.3	29.5	15.2	7.9	
7-Sep-08	3982		2R11L	Nest	62	29.7	32.7	29.1	16.2	8.4	
7-Sep-08	3983	3984	2R11L	Nest	62	27.9	32.1	27.4	15.0	7.3	
7-Sep-08	3985		2R11L	Nest	62	28.7	32.5	28.9	14.5	7.6	
7-Sep-08	3987		2R11L	Nest	62	28.4	31.9	28.0	14.8	7.6	
7-Sep-08	3988		2R11L	Nest	62	29.1	32.8	28.6	15.8	7.7	
7-Sep-08	3990		2R9L	Nest	62	31.2	34.5	29.7	16.0	9.0	
7-Sep-08	3991	3992	2R9L	Nest	62	28.1	33.5	28.7	15.4	7.7	
7-Sep-08	15358		2R9L	Nest	62	28.7	32.7	29.3	15.4	7.7	
7-Sep-08	15361	15362	2R9L	Nest	62	28.1	33.4	29.0	15.4	8.0	
7-Sep-08	15363		2R9L	Nest	62	28.8	32.6	28.9	16.1	8.2	
7-Sep-08	15364	15365	2R9L	Nest	62	28.9	33.3	28.8	14.4	7.4	
7-Sep-08	15366	15367	2R9L	Nest	62	28.9	31.9	28.9	15.2	7.6	
7-Sep-08	15368		2R9L	Nest	62	29.9	32.9	29.1	15.6	8.4	
7-Sep-08	15369	15370	2R9L	Nest	62	27.6	31.4	27.0	15.2	7.3	
7-Sep-08	15371		2R9L	Nest	62	30	32.3	29.1	17.2	8.1	
7-Sep-08	15373		2R9L	Nest	62	29.1	33.3	28.2	15.2	7.9	
7-Sep-08	15376		2R9L	Nest	62	29.1	33.3	28.1	15.9	7.8	
7-Sep-08	15379	15380	2R9L	Nest	62	28.1	31.9	26.7	15.1	7.2	
7-Sep-08	15381		2R9L	Nest	62	27.9	31.7	28.6	14.8	7.9	
7-Sep-08	15383		2R9L	Nest	91	26.3	30.0	26.4	15.1	6.6	
7-Sep-08	15384	15385	2R9L	Nest	91	25.0	29.5	25.8	15.7	7.1	
7-Sep-08	15386		2R9L	Nest	91	27.6	31.8	27.2	15.9	7.6	
7-Sep-08	15389	15390	2R9L	Nest	91	23.4	26.7	23.9	14.5	5.6	
7-Sep-08	15391		2R9L	Nest	91	24.3	28.2	24.5	14.9	5.9	
7-Sep-08	15393		2R11R	Nest	66	27.9	32.4	28.2	15.8	7.8	
7-Sep-08	15394	15395	2R11R	Nest	66	28.8	31.8	27.6	14.9	7.5	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	15396		2R11R	Nest	66	30.4	32.8	28.9	16.5	8.8	6 Vert.
7-Sep-08	15397	15398	2R11R	Nest	66	28.3	31.5	27.5	15.4	7.6	
7-Sep-08	15399	15400	2R11R	Nest	66	27.3	29.2	26.3	14.4	7.5	5 Cost.(R&L)
7-Sep-08	15401		2R11R	Nest	66	28.8	31.6	27.8	15.7	7.7	
7-Sep-08	15402	15403	2R11R	Nest	66	29.0	31.7	28.4	15.8	8.0	5 Cost.(R)
7-Sep-08	15404		2R11R	Nest	66	28.3	30.4	27.6	15.7	7.7	
7-Sep-08	15406		2R11R	Nest	66	28.2	29.9	26.3	15.5	7.3	
7-Sep-08	15407	15408	2R11R	Nest	66	29.7	32.4	28.0	14.8	8.0	
7-Sep-08	15409		2R12R	Nest	119	29.3	31.8	28.3	15.5	8.1	
7-Sep-08	15412	15413	2R12R	hand	119	27.6	30.8	27.9	15.2	7.7	
7-Sep-08	15414		2R12R	hand	119	27.6	31.0	27.8	15.3	7.1	Nuchal Divided
7-Sep-08	15415	15416	2R12R	Nest	119	27.1	30.1	28.0	14.8	7.2	
7-Sep-08	15417		2R12R	Nest	119	27.9	32.0	28.1	15.7	7.7	
7-Sep-08	15419		2R12R	Nest	119	26.7	29.3	24.1	14.9	6.4	6 Vert., 6 Cost(L)
7-Sep-08	15420	15421	2R12R	Nest	119	27.8	31.3	28.5	15.3	7.6	
7-Sep-08	15422		2R12R	Nest	119	28.2	31.6	28.1	14.9	7.3	6 Vert., 6 Cost(L)
7-Sep-08	15424		2R12R	Nest	119	27.9	31.1	27.9	15.4	7.4	
7-Sep-08	15425	15426	2R12R	Nest	119	28.5	32.0	28.4	15.7	8.5	
7-Sep-08	15427		2R9L	Nest	119	26.1	29.5	26.1	14.6	6.1	Nuchal Divided
7-Sep-08	15428	15429	2R9L	Nest	119	28.1	30.5	26.8	15.1	7.5	
7-Sep-08	15430	15431	2R9L	Nest	119	27.5	30.8	28.4	15.4	7.6	
7-Sep-08	15432		2R9L	Nest	119	28.1	31.1	28.5	15.3	7.6	
7-Sep-08	15433	15434	2R9L	Nest	119	27.9	31.1	28.0	15.8	7.6	
7-Sep-08	15435		2R12L	Nest	104	29.1	33.9	31.0	16.9	9.0	
7-Sep-08	15437		2R12L	Nest	104	30.4	33.6	29.8	16.0	9.0	
7-Sep-08	15438	15439	2R12L	Nest	104	29.5	33.6	28.4	17.4	9.1	
7-Sep-08	15440		2R12L	Nest	104	28.8	32.6	28.8	16.2	8.4	13 Marg.(L)
7-Sep-08	15442		2R12L	Nest	104	30.7	34.8	30.0	16.5	9.3	
7-Sep-08	15443	15444	2R12L	Nest	104	30.5	33.5	29.0	16.0	9.2	
7-Sep-08	15446	15447	2R12L	Nest	104	30.4	33.9	27.7	17.5	9.0	
7-Sep-08	15448		2R12L	Nest	104	29.7	31.8	28.4	16.5	8.7	
7-Sep-08	15450		2R12L	Nest	104	29.3	32.3	29.9	16.0	8.6	13 Marg.(R), 6 Vert., 5 Cost(R&L)
7-Sep-08	15451	15452	2R12L	Nest	104	30.3	33.2	28.5	16.5	9.0	
7-Sep-08	15453		2R9L	Nest	104	28.8	33.2	30.1	16.8	9.2	
7-Sep-08	15454	15455	2R9L	Nest	104	29.5	33.4	29.5	16.1	8.7	
7-Sep-08	15456		2R9L	Nest	104	30.0	34.7	29.9	16.5	9.2	
7-Sep-08	15458		2R9L	Nest	104	31.7	34.0	29.4	16.2	9.3	
7-Sep-08	15459	15460	2R9L	Nest	128	30.1	32.7	29.3	16.1	8.9	
7-Sep-08	15461		2R8L9L	Nest	31	25.9	29.3	26.7	15.2	6.3	13 Marg.(R&L)
7-Sep-08	15463		2R8L9L	Nest	31	25.5	29.1	25.1	14.0	5.7	13 Marg.(R&L)
7-Sep-08	15464		2R8L9L	Nest	31	25.8	27.8	26.2	14.7	6.3	13 Marg.(R&L), 5 Cost.(R&L), 6 Vert.
7-Sep-08	15466		2R8L9L	Nest	31	26.4	29.0	26.2	14.2	6.0	13 Marg.(R&L), 5 Cost.(R&L)
7-Sep-08	15467	15468	2R8L9L	Nest	31	26.2	29.2	25.6	13.9	5.9	
7-Sep-08	15469		2R8L9L	Nest	31	25.5	29.8	26.3	14.4	6.3	13 Marg.(R&L), 5 Cost.(R&L)
7-Sep-08	15471		2R8L9L	Nest	31	25.3	29.0	25.9	13.9	5.7	
7-Sep-08	15472	15473	2R8L9L	Nest	31	25.6	29.2	26.0	14.2	5.8	13 Marg.(R&L), 5 Cost.(R&L), No Nuchal
7-Sep-08	15474		2R8L9L	Nest	31	26.7	29.2	26.4	14.4	6.4	13 Marg.(R)

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	15475	15476	2R8L9L	Nest	31	25.2	29.3	26.4	13.9	6.1	
7-Sep-08	15477	15478	2R8L9L	Nest	31	26.1	29.2	26.9	13.6	6.0	13 Marg.(R&L), 5 Cost.(R&L)
7-Sep-08	15479		2R8L9L	Nest	31	26.1	29.5	26.1	14.5	6.0	13 Marg.(R&L), 5 Cost.(R&L)
7-Sep-08	15480	15481	2R9L	Nest	31	25.2	29.1	25.5	13.8	5.8	
7-Sep-08	15482		2R9L	Nest	31	26.4	29.8	27.0	14.4	6.2	
7-Sep-08	15484		2R9L	Nest	31	25.3	29.5	26.7	13.6	6.0	
7-Sep-08	15485	15486	2R9L	Nest	31	26.2	29.4	26.5	14.5	6.1	13 Marg.(R&L)
7-Sep-08	15487		2R9L	Nest	31	26.3	29.1	25.9	14.0	6.0	13 Marg.(R&L), 5 Cost.(R&L)
7-Sep-08	15488	15489	2R9L	Nest	31	26.0	29.6	26.8	13.7	6.1	
7-Sep-08	15490	15491	2R9R	Nest	57	28.1	32.0	28.4	15.3	7.6	
7-Sep-08	15492		2R9R	Nest	57	28.0	32.6	28.4	16.3	8.1	
7-Sep-08	15493	15494	2R9R	Nest	57	28.2	32.5	28.2	15.3	7.7	
7-Sep-08	15495		2R9R	Nest	57	29.3	32.8	27.6	15.7	7.7	
7-Sep-08	15497		2R9R	Nest	57	26.2	30.2	27.5	15.2	7.2	
7-Sep-08	15498	15499	2R9R	Nest	57	29.4	32.5	29.0	16.4	8.2	
7-Sep-08	15500		2R9R	Nest	57	29.0	32.0	28.6	16.6	7.8	
7-Sep-08	15502		2R9R	Nest	57	29.1	32.5	29.2	15.5	8.1	
7-Sep-08	15503	15504	2R9R	Nest	57	28.5	31.5	28.0	14.8	7.9	
7-Sep-08	15505		2R9R	Nest	57	27.9	30.4	28.5	15.9	7.6	
7-Sep-08	15506	15507	2R9R	Nest	57	28.1	31.8	28.9	16.2	8.0	
7-Sep-08	15508		2R9L	Nest	57	28.0	32.3	28.5	16.2	8.3	
7-Sep-08	15510		2R9L	Nest	57	27.2	32.6	28.7	16.1	8.0	
7-Sep-08	15511	15512	2R9L	Nest	57	27.2	29.8	27.5	16.0	7.3	
7-Sep-08	15513		2R9L	Nest	57	28.1	32.6	29.0	15.3	8.1	Nuchal Divided, 6Vert.
7-Sep-08	15516	15517	2R9L	Nest	57	27.9	31.0	28.1	15.9	7.6	
7-Sep-08	15518		2R9L	Nest	57	27.3	31.6	27.9	15.6	8.1	
7-Sep-08	15520		2R9L	Nest	57	28.9	31.8	29.0	16.1	8.2	Nuchal Divided
7-Sep-08	15521	15522	2R9L	Nest	57	28.4	32.0	28.2	15.7	7.9	Nuchal Divided
7-Sep-08	15523		2R10R	Nest	43	30.0	33.3	29.4	15.0	6.8	Nuchal Divided
7-Sep-08	15524	15525	2R10R	Nest	43	29.0	32.9	30.2	15.3	8.3	
7-Sep-08	15526		2R10R	Nest	43	28.2	31.6	29.2	16.4	8.1	Nuchal Divided
7-Sep-08	15528		2R10R	Nest	43	29.5	32.5	30.1	16.8	8.8	Nuchal Divided
7-Sep-08	15529	15530	2R10R	Nest	43	28.4	32.3	28.7	15.9	8.1	Nuchal Divided
7-Sep-08	15531		2R10R	Nest	43	29.4	33.1	30.0	16.4	8.6	Nuchal Divided
7-Sep-08	15533		2R10R	Nest	43	29.9	32.9	27.7	16.4	8.4	Nuchal Divided
7-Sep-08	15534	15535	2R10R	Nest	43	29.9	32.6	29.9	16.2	8.4	Nuchal Divided
7-Sep-08	15536		2R10R	Nest	43	28.5	31.4	28.6	16.1	7.8	
7-Sep-08	15537	15538	2R10R	Nest	43	29.4	32.2	29.2	16.2	8.1	Nuchal Divided
7-Sep-08	15539	15540	2R9L	Nest	43	28.8	32.1	30.2	15.5	8.0	
7-Sep-08	15541		2R9L	Nest	43	27.5	31.2	29.2	15.0	7.4	
7-Sep-08	15542	15543	2R9L	Nest	43	27.6	32.0	29.5	16.0	7.5	
7-Sep-08	15544		2R9L	Nest	44	29.9	33.0	28.7	16.1	8.6	
7-Sep-08	15546		2R9L	Nest	44	31.0	33.8	30.0	16.5	8.6	
7-Sep-08	15547	15548	2R9L	Nest	44	29.1	32.6	29.8	16.1	7.8	Nuchal Divided
7-Sep-08	15549		2R9L	Nest	44	30.1	32.3	28.4	16.1	8.5	
7-Sep-08	15550	15551	2R9L	Nest	44	29.3	32.0	28.5	16.0	8.1	
7-Sep-08	15552	15553	2R9L	Nest	44	28.4	32.2	28.3	15.6	7.7	
7-Sep-08	15554		2R9L	Nest	44	29.8	33.8	30.0	16.4	8.2	
7-Sep-08	15555	15556	2R9L	Nest	44	30.1	33.4	29.4	16.0	8.2	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	15557		2R9L	Nest	44	29.2	32.1	29.2	16.4	8.3	6 Vert., V5 divided, 13 Marg.(L)
7-Sep-08	15559		2R9L	Nest	155	27.5	29.7	28.4	15.9	7.7	
7-Sep-08	15560	15561	2R9L	Nest	155	26.3	29.3	26.9	15.0	7.3	5 Cost.(R)
7-Sep-08	15562		2R9L	Nest	155	28.3	30.6	27.7	16.1	8.4	Nuchal Divided
7-Sep-08	15564		2R9L	Nest	155	28.0	32.1	29.7	16.2	9.1	
7-Sep-08	15565	15566	2R9L	Nest	155	28.1	31.0	29.1	16.5	8.9	6 Vert.
7-Sep-08	15567		2R9L	Nest	155	26.8	29.9	27.4	16.1	7.9	
7-Sep-08	15568	15569	2R9L	Nest	155	27.1	29.6	25.9	15.1	7.4	13 Marg.(L)
7-Sep-08	15570		2R9L	Nest	155	27.4	31.6	29.0	16.1	8.6	5 Cost®
7-Sep-08	15572		2R9L	Nest	155	27.0	31.9	29.2	16.6	8.7	
7-Sep-08	15574		2R9L	Nest	105	28.3	30.3	27.4	15.1	7.3	Nuchal Divided
7-Sep-08	15575		2R9L	Nest	105	29.0	32.5	29.0	16.2	8.6	Nuchal Divided
7-Sep-08	15577		2R9L	Nest	105	28.8	31.7	28.2	15.9	8.0	Nuchal Divided
7-Sep-08	15578	15579	2R9L	Nest	105	30.6	33.1	29.4	15.1	8.4	Nuchal Divided
7-Sep-08	15580		2R9L	Nest	105	29.3	32.5	28.2	15.6	8.2	Nuchal Divided, 6 Vert., 5 Cost®
7-Sep-08	15581	15582	2R9L	Nest	105	26.3	30.1	26.6	14.7	6.6	Nuchal Divided
7-Sep-08	15583	15584	2R9L	Nest	105	28.8	30.6	27.8	15.1	7.8	Nuchal Divided, 13 Marg.(R), 5 Cost.(L)
7-Sep-08	15585		2R9L	Nest	105	28.2	31.8	28.2	15.0	8.0	Nuchal Divided
7-Sep-08	15586	15587	2R9L	Nest	105	28.2	30.6	26.7	14.7	7.4	Nuchal Divided, 5 Cost.(L) but very small
7-Sep-08	15588		2R9L	Nest	105	30.2	32.7	28.4	16.4	9.0	
7-Sep-08	15590		2R9L	Nest	105	27.7	30.6	28.3	15.5	8.0	Nuchal Divided, 13 Marg.(R), 5 Cost.(R)
7-Sep-08	15591	15592	2R9L	Nest	105	28.4	31.5	26.5	16.1	7.8	Nuchal Divided
7-Sep-08	15593		2R9L	Nest	92	28.1	30.6	27.2	15.6	7.4	Nuchal Divided
7-Sep-08	15594	15595	2R9L	Nest	92	27.9	31.2	26.4	14.8	6.9	
7-Sep-08	15596		2R9L	Nest	92	29.2	31.7	28.2	15.1	7.3	
7-Sep-08	15598		2R9L	Nest	92	27.4	31.1	28.1	14.9	7.4	
7-Sep-08	15599	15600	2R9L	Nest	92	27.9	31.1	26.8	15.2	6.9	
7-Sep-08	15601		2R9L	Nest	92	27.5	30.9	26.7	15.5	7.1	
7-Sep-08	15603		2R9L	Nest	92	27.8	30.5	26.7	15.4	6.8	
7-Sep-08	15604	15605	2R9L	Nest	92	28.1	30.7	26.5	15.2	6.8	
7-Sep-08	15606		2R9L	Nest	92	27.9	30.6	27.0	16.0	6.8	
7-Sep-08	15607	15608	2R9L	Nest	92	27.0	30.1	26.5	15.4	6.9	
7-Sep-08	15609	15610	2R9L	Nest	92	27.4	30.1	27.1	15.9	6.8	
7-Sep-08	15611		2R9L	Nest	92	28.1	31.1	25.8	15.8	7.0	
7-Sep-08	15612	15613	2R9L	Nest	92	27.7	31.3	26.9	15.3	6.9	
7-Sep-08	15614		2R9L	Nest	107	27.8	30.4	26.2	14.5	6.8	
7-Sep-08	15616		2R9L	Nest	107	28.0	31.2	27.3	14.6	7.6	
7-Sep-08	15617	15618	2R9L	Nest	107	28.0	31.2	27.7	16.0	7.6	Nuchal Divided
7-Sep-08	15619		2R9L	Nest	107	27.8	31.5	27.9	15.6	7.7	Nuchal Divided
7-Sep-08	15620	15621	2R9L	Nest	107	28.5	31.6	27.5	15.3	7.7	
7-Sep-08	15622		2R9L	Nest	107	27.8	31.8	27.0	15.4	6.9	
7-Sep-08	15624		2R9L	Nest	107	27.6	30.8	28.1	14.3	7.2	
7-Sep-08	15625	15626	2R9L	Nest	107	28.1	31.2	27.5	15.2	7.4	5 Cost.(L) Very small
7-Sep-08	15627		2R9L	Nest	107	27.8	30.4	27.0	14.8	7.2	Nuchal Divided
7-Sep-08	15628	15629	2R9L	Nest	107	28.2	31.7	27.6	15.3	7.4	Nuchal Divided
7-Sep-08	15630		2R9L	Nest	107	29.1	32.2	28.2	15.2	7.7	
7-Sep-08	15632		2R9L	Nest	107	27.9	31.2	27.8	14.8	7.2	Nuchal Divided
7-Sep-08	15633	15634	2R9L	Nest	107	27.9	31.3	27.4	15.4	7.6	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	15635		2R9L	Nest	107	27.6	30.6	27.1	15.4	7.2	Nuchal Divided
7-Sep-08	15637		2R9L	Nest	56	28.0	32.1	29.0	16.2	8.1	Nuchal Divided
7-Sep-08	15638	15639	2R9L	Nest	56	28.4	31.9	27.0	16.5	8.1	
7-Sep-08	15640		2R9L	Nest	56	26.5	30.9	27.9	16.1	7.9	
7-Sep-08	15641	15642	2R9L	Nest	56	26.9	31.8	27.7	16.0	7.6	
7-Sep-08	15643		2R9L	Nest	56	27.1	31.2	27.8	15.6	7.4	Nuchal Divided
7-Sep-08	15644		2R9L	Nest	56	28.3	32.7	29.0	16.0	8.1	
7-Sep-08	15646	15647	2R9L	Nest	56	27.3	31.1	27.2	16.3	7.7	
7-Sep-08	15648		2R9L	Nest	56	25.5	29.0	26.1	15.2	6.8	
7-Sep-08	15649	15650	2R9L	Nest	56	27.2	30.8	26.8	15.6	7.3	
7-Sep-08	15651		2R9L	Nest	56	26.4	30.9	27.3	15.7	7.2	
7-Sep-08	15653		2R9L	Nest	56	26.1	30.9	27.4	16.0	7.3	Nuchal Divided
7-Sep-08	15654		2R9L	Nest	56	26.6	30.0	28.0	15.6	7.3	Nuchal Divided
7-Sep-08	15656		2R9L	Nest	36	29.1	32.2	29.2	15.8	8.1	
7-Sep-08	15657		2R9L	Nest	36	30.2	32.6	28.9	16.2	8.2	
7-Sep-08	15659	15660	2R9L	Nest	36	29.3	32.3	29.1	16.2	8.3	
7-Sep-08	15661		2R9L	Nest	36	29.1	32.4	28.9	16.1	8.1	
7-Sep-08	15664		2R9L	Nest	36	29.7	32.2	28.6	14.8	7.9	
7-Sep-08	15666		2R9L	Nest	36	30.3	32.3	28.8	15.5	8.1	
7-Sep-08	15667	15668	2R9L	Nest	36	29.2	31.1	29.6	15.5	8.3	
7-Sep-08	15670	15671	2R9L	Nest	36	29.1	32.1	29.1	15.1	8.0	
7-Sep-08	15672		2R9L	Nest	36	30.2	33.2	30.2	15.6	8.4	
7-Sep-08	15674		2R9L	Nest	36	29.9	32.5	29.3	16.2	8.5	
7-Sep-08	15675	15676	2R9L	Nest	36	30.2	33.0	29.2	16.5	8.7	
7-Sep-08	15677		2R9L	Nest	4	29.8	33.2	28.7	15.3	7.9	Nuchal Divided
7-Sep-08	15679		2R9L	Nest	4	29.2	33.3	28.2	15.8	8.0	
7-Sep-08	15680	15681	2R9L	Nest	4	29.3	33.0	28.1	15.1	8.1	
7-Sep-08	15683	15684	2R9L	Nest	4	25.1	28.0	25.3	14.6	6.1	7 Vert., 3 Cost.(R)
7-Sep-08	15685		2R9L	Nest	4	28.9	32.3	27.9	14.9	7.5	Nuchal Divided
7-Sep-08	15687		2R9L	Nest	4	29.1	32.6	28.1	15.7	7.5	
7-Sep-08	15688	15689	2R9L	Nest	4	29.2	32.3	27.9	15.6	7.8	
7-Sep-08	15690		2R9L	Nest	4	29.6	34.1	29.0	15.0	8.3	
7-Sep-08	15692		2R9L	Nest	4	29.3	32.8	28.4	15.5	7.7	Nuchal Divided
7-Sep-08	15693	15694	2R9L	Nest	4	29.4	32.3	27.9	15.2	7.9	
7-Sep-08	15695		2R9L	Nest	4	28.1	31.6	27.8	15.4	7.5	Nuchal Divided
7-Sep-08	15696	15697	2R9L	Nest	49/74	29.4	32.5	28.5	15.5	7.3	Coloration very light, exhibiting strange behavior: walks lopsided with head extended up, flips over on its back and cannot right itself. Uppon release got into water and spun in circles on its back, probably died.
7-Sep-08	15698		2R9L	Nest	49/74	28.8	32.1	28.2	15.5	7.8	
7-Sep-08	15700		2R9L	Nest	49/74	27.6	31.5	27.1	16.0	7.7	
7-Sep-08	15701	15702	2R9L	Nest	49/74	28.7	32.6	29.0	15.8	8.4	Nuchal Divided
7-Sep-08	15703		2R9L	Nest	49/74	29.6	33.0	28.9	15.6	8.1	
7-Sep-08	15705		2R9L	Nest	49/74	27.9	31.5	28.3	15.9	7.6	Nuchal Divided
7-Sep-08	15706	15707	2R9L	Nest	49/74	27.7	31.0	26.8	15.6	7.5	
7-Sep-08	15708		2R9L	Nest	49/74	29.2	33.5	29.5	15.8	8.4	Nuchal Divided

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
7-Sep-08	15709	15710	2R9L	Nest	49/74	28.0	30.7	27.3	15.6	7.7	
7-Sep-08	15711	15712	2R9L	Nest	49/74	28.7	33.1	29.8	15.7	8.1	Nuchal Divided
7-Sep-08	15713		2R9L	Nest	49/74	28.5	33.2	29.2	16.2	8.1	
7-Sep-08	15714	15715	2R9L	Nest	49/74	28.8	31.4	28.1	15.0	8.0	Nuchal Divided
7-Sep-08	15716		2R9L	Nest	49/74	28.6	31.8	27.8	15.8	8.0	
7-Sep-08	15718		2R9L	Nest	49/74	28.0	31.1	27.2	15.2	7.5	
7-Sep-08	15719	15720	2R9L	Nest	49/74	27.1	30.2	26.9	15.7	7.7	5 Vert.
7-Sep-08	15721		2R9L	Nest	49/74	28.9	31.3	27.7	15.0	7.7	
7-Sep-08	15723		2R9L	Nest	49/74	28.2	32.6	29.3	15.8	8.0	Nuchal Divided
7-Sep-08	15724	15725	2R9L	Nest	49/74	28.7	33.9	29.8	16.1	8.2	Nuchal Divided
7-Sep-08	15726		2R9L	Nest	49/74	26.7	30.2	26.5	15.1	7.1	
7-Sep-08	15727	15728	2R9L	Nest	49/74	28.2	32.3	29.2	15.4	7.5	
7-Sep-08	15729		2R9L	Nest	49/74	28.1	30.6	27.0	15.0	7.5	Nuchal Divided, 5 Cost.(L)
7-Sep-08	15731		2R9L	Nest	49/74	28.1	33.1	29.1	16.1	8.4	Nuchal Divided
7-Sep-08	15732	15733	2R9L	Nest	49/74	27.9	30.4	27.3	15.6	7.6	Nuchal Divided
7-Sep-08	15734		2R9L	Nest	49/74	28.2	32.1	27.5	15.7	8.0	
7-Sep-08	15736		2R9L	Nest	49/74	28.5	31.7	27.8	15.2	8.1	5 Cost.(R)
7-Sep-08	15737	15738	2R9L	Nest	49/74	27.9	31.1	26.6	15.3	7.7	5 Cost.(R)
7-Sep-08	15739		2R9L	Nest	91?	30.0	32.5	29.9	15.8	7.9	Turtle escaped from container
7-Sep-08	15740	15741	2R9L	Nest	202	28.1	32.0	27.8	16.0	8.1	
7-Sep-08	15742		2R9L	Nest	202	28.8	32.3	28.1	16.3	8.2	
7-Sep-08	15745	15746	2R9L	Nest	202	27.9	31.0	27.9	15.1	7.8	
7-Sep-08	15747		2R9L	Nest	202	26.2	29.4	25.4	14.8	6.2	
7-Sep-08	15748	15749	2R9L	Nest	202	25.3	28.9	25.9	14.5	6.4	
7-Sep-08	15750	15751	2R9L	Nest	202	23.8	26.3	24.2	12.8	4.9	Nuchal Divided, 5 Cost.(L), 6 Vert.
7-Sep-08	15753	15754	2R9L	Nest	2	24.4	27.8	23.5	14.7	5.8	
7-Sep-08	15755		2R9L	Nest	127	25.2	28.9	26.3	15.8	7.1	
7-Sep-08	15757		2R9L	Nest	61	27.6	30.7	28.5	14.8	6.9	
7-Sep-08	15758	15759	2R9L	Nest	61	28.0	30.0	26.1	15.3	7.0	
7-Sep-08	15760		2R9L	Nest	61	27.2	31.4	28.6	15.8	7.7	
7-Sep-08	15761	15762	2R9L	Nest	61	27.1	31.0	28.2	15.6	7.4	
7-Sep-08	15763	15764	2R9L	Nest	61	27.2	30.6	28.4	15.1	7.2	
7-Sep-08	15765		2R9L	Nest	61	28.2	30.2	26.6	16.1	7.3	
7-Sep-08	15766	15767	2R9L	Nest	61	27.7	29.5	27.7	14.4	7.3	
7-Sep-08	15768		2R9L	Nest	61	26.8	29.1	27.8	14.8	7.2	
7-Sep-08	15770		2R9L	Nest	61	28.7	32.0	28.9	15.6	8.4	
7-Sep-08	15771	15772	2R9L	Nest	61	28.7	31.5	29.5	15.3	7.8	
7-Sep-08	15773		2R9L	Nest	61	28.1	31.1	28.0	15.7	7.7	
7-Sep-08	15774		2R9L	Nest	61	27.5	31.0	28.8	15.1	7.3	
7-Sep-08	15776	15777	2R9L	Nest	61	29.0	32.0	28.3	15.3	7.8	
7-Sep-08	15982		2R9L	Nest	4	28.6	31.5	28.2	15.5	7.5	
15-Sep-08	15779	15780	2R9L	Nest	147	26.8	30.5	27.6	15.2	7.0	3 Cost.(R), 4th Cost.(L) greatly reduced
15-Sep-08	15781		2R9L	Nest	147	26.6	31.3	27.1	16.0	7.3	
15-Sep-08	15783		2R9L	Nest	147	27.9	31.1	27.6	15.1	7.1	5 Cost.(R&L)
15-Sep-08	15784	15785	2R9L	Nest	147	28.0	31.9	29.4	16.3	8.4	Nuchal Divided
15-Sep-08	15786		2R9L	Nest	147	29.9	32.8	29.0	16.3	8.2	Nuchal Divided, 6 Vert., 5 Cost(R&L)-very small

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
15-Sep-08	15788		2R9L	Nest	147	26.5	29.6	26.8	15.3	6.4	
15-Sep-08	15789	15790	2R9L	Nest	147	29.5	32.6	28.8	16.0	8.1	
15-Sep-08	15791		2R9L	Nest	147	28.0	31.4	28.6	15.6	7.0	Nuchal Divided
15-Sep-08	15792	15793	2R9L	Nest	147	28.0	32.0	29.1	15.8	8.0	
15-Sep-08	15794		2R9L	Nest	147	28.8	32.7	30.2	16.0	8.1	Nuchal Divided
15-Sep-08	15796		2R9L	Nest	147	16.2	29.3	25.8	15.2	6.3	
15-Sep-08	15797	15798	2R9L	Nest	147	29.4	34.5	29.0	16.3	8.1	Nuchal Divided
15-Sep-08	15799		2R9L	Nest	147	28.7	32.3	28.7	15.3	7.7	6 Vert.
15-Sep-08	15801		2R9L	Nest	168	23.5	27.0	23.7	14.1	5.4	
15-Sep-08	15802	15803	2R9L	Nest	168	25.0	28.3	24.5	14.6	6.1	5 Cost.(R&L)
15-Sep-08	15804		2R9L	Nest	168	26.3	30.9	27.7	14.9	7.8	
15-Sep-08	15806		2R9L	Nest	168	26.3	29.7	26.0	15.5	7.1	
15-Sep-08	15807	15808	2R9L	Nest	168	23.1	26.4	22.8	13.8	4.7	
15-Sep-08	15809		2R9L	Nest	168	26.0	29.8	25.6	15.2	7.0	5 Cost.(R)
15-Sep-08	15811		2R9L	Nest	168	25.0	28.8	24.1	14.2	6.5	
15-Sep-08	15812		2R9L	Nest	168	23.9	27.2	24.1	13.6	5.3	
25-Sep-08	15813	15814	2R9L	Nest	169	25.2	28.3	25.1	14.9	6.1	Nuchal Divided
25-Sep-08	15815		2R9L	Nest	169	28.1	32.3	28.4	15.7	7.8	Nuchal Divided
25-Sep-08	15816		2R9L	Nest	169	28.0	31.1	27.8	16.3	8.5	Nuchal Divided
29-Sep-08	15817		2R9L	Nest	109	28.4	32.6	28.9	15.5	8.4	Nuchal Divided
29-Sep-08	15819		2R9L	Nest	109	29.8	32.8	28.3	15.7	8.1	Nuchal Divided
29-Sep-08	15820	15821	2R9L	Nest	109	27.7	30.7	26.6	14.7	6.8	
29-Sep-08	15822		2R9L	Nest	109	30.6	33.7	27.4	17.1	8.6	
29-Sep-08	15824		2R9L	Nest	109	29.2	32.1	28.3	15.6	7.8	Nuchal Divided
29-Sep-08	15825	15826	2R9L	Nest	109	29.6	33.1	30.0	16.2	8.5	Nuchal Divided
29-Sep-08	15827		2R9L	Nest	109	30.1	33.3	29.4	15.5	8.3	Nuchal Divided
29-Sep-08	15829		2R9L	Nest	109	29.1	32.3	27.4	16.4	7.8	Nuchal Divided
29-Sep-08	15830	15831	2R9L	Nest	159	29.4	32.9	30.2	15.0	7.7	
29-Sep-08	15832		2R9L	Nest	150	26.0	28.8	26.3	15.6	8.1	Nuchal Divided, 5 Cost., asymetrical plastaron
29-Sep-08	15833	15834	2R9L	Nest	150	29.0	30.5	26.8	15.4	7.6	5 Cost.(R&L)
29-Sep-08	15835		2R9L	Nest	150	29.6	32.0	28.5	16.0	8.0	
29-Sep-08	15837		2R9L	Nest	150	30.0	32.7	28.8	16.8	8.8	5 Cost.(L)
29-Sep-08	15838	15839	2R9L	Nest	150	29.8	31.8	28.5	16.4	8.4	
29-Sep-08	15840		2R9L	Nest	150	23.7	26.0	24.3	14.3	5.5	
29-Sep-08	15842		2R9L	Nest	150	30.0	30.7	28.5	16.0	8.3	
29-Sep-08	15843	15844	2R9L	Nest	150	29.0	30.7	28.0	15.2	7.6	
29-Sep-08	15845		2R9L	Nest	150	28.1	30.1	26.8	15.2	7.3	5 Cost.(R&L)
29-Sep-08	15847		2R9L	Nest	150	30.7	32.5	28.9	16.5	8.7	7 Vert., V4 divided
29-Sep-08	15848	15849	2R9L	Nest	150	26.2	29.5	26.8	15.0	6.7	
29-Sep-08	15850		2R9L	Nest	118	28.1	31.5	29.2	15.2	7.6	
29-Sep-08	15851	15852	2R9L	Nest	118	26.9	31.4	27.5	15.3	6.9	
29-Sep-08	15853		2R9L	Nest	118	26.7	31.1	28.1	15.0	6.8	Nuchal Divided
29-Sep-08	15855		2R9L	Nest	118	27.7	32.0	29.0	15.4	7.7	
29-Sep-08	15856	15857	2R9L	Nest	118	27.8	32.0	29.3	15.1	7.7	Nuchal Divided
29-Sep-08	15858		2R9L	Nest	118	27.7	32.1	29.3	15.7	7.8	
29-Sep-08	15860		2R9L	Nest	118	27.0	32.0	29.2	16.1	7.3	
29-Sep-08	15861	15862	2R9L	Nest	118	28.1	31.2	27.8	15.2	7.3	
29-Sep-08	15863		2R9L	Nest	118	27.4	31.4	28.1	16.1	7.5	
29-Sep-08	15864	15865	2R9L	Nest	118	27.7	31.0	27.9	15.0	7.3	
29-Sep-08	15866		2R9L	Nest	118	27.5	30.8	29.4	16.0	7.6	
29-Sep-08	15868		2R9L	Nest	118	27.8	32.0	28.5	15.7	7.8	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
29-Sep-08	15869	15870	2R9L	Nest	118	28.1	31.6	30.0	15.8	8.1	Nuchal Divided
29-Sep-08	15871		2R9L	Nest	118	27.4	31.4	28.8	15.1	7.3	
29-Sep-08	15873		2R9L	Nest	118	27.2	31.0	29.9	16.3	7.5	
29-Sep-08	15874	15875	2R9L	Nest	175	26.3	29.8	28.1	15.0	7.0	Nuchal Divided
29-Sep-08	15876		2R9L	Nest	175	28.5	32.4	29.3	16.4	8.9	
29-Sep-08	15878		2R9L	Nest	175	27.0	30.1	28.1	16.1	7.4	Nuchal Divided
29-Sep-08	15879		2R9L	Nest	175	24.3	28.5	26.4	14.5	5.7	Nuchal Divided
29-Sep-08	15881		2R9L	Nest	175	30.0	33.9	30.1	16.4	9.1	Nuchal Divided
29-Sep-08	15882	15883	2R9L	Nest	175	26.5	29.3	27.0	14.8	6.3	Nuchal Divided
29-Sep-08	15884		2R9L	Nest	175	29.9	33.6	30.0	16.7	9.5	
29-Sep-08	15886		2R9L	Nest	135	30.5	33.5	30.5	16.6	9.0	
29-Sep-08	15887	15888	2R9L	Nest	135	29.9	33.8	30.3	16.4	9.0	
29-Sep-08	15889		2R9L	Nest	135	30.5	32.4	30.1	16.6	9.0	
29-Sep-08	15891		2R9L	Nest	135	29.4	32.6	29.8	16.0	8.4	
29-Sep-08	15892		2R9L	Nest	135	32.2	34.0	29.1	16.2	8.5	
29-Sep-08	15894		2R9L	Nest	135	29.5	33.1	30.3	16.0	8.7	
29-Sep-08	15895	15896	2R9L	Nest	135	27.8	32.0	28.2	16.0	7.9	
29-Sep-08	15897		2R9L	Nest	135	27.2	29.8	27.5	14.7	6.3	
29-Sep-08	15899		2R9L	Nest	135	27.3	30.3	26.5	14.9	6.4	
29-Sep-08	15900	15901	2R9L	Nest	135	29.7	32.9	29.8	16.5	8.7	
30-Sep-08	15902		2R9L	Nest	151	30.4	33.3	29.5	16.0	8.3	7 Vert., 5 Cost.(R), 6 Cost.(L)
30-Sep-08	15903	15904	2R9L	Nest	151	29.7	33.6	29.1	16.0	8.4	
30-Sep-08	15905		2R9L	Nest	151	29.3	33.0	28.5	15.5	8.6	
30-Sep-08	15907		2R9L	Nest	151	27.1	30.0	27.1	14.6	6.3	7 Vert., 5 Cost.(R), 6 Cost.(L)
30-Sep-08	15908	15909	2R9L	Nest	151	28.1	32.8	29.6	15.3	8.3	
30-Sep-08	15910		2R9L	Nest	151	29.1	32.8	29.2	15.9	8.9	
30-Sep-08	15912		2R9L	Nest	151	30.0	33.4	29.0	15.1	8.4	6 Vert., 5 Cost.(R), 6 Cost.(L)
30-Sep-08	15913		2R9L	Nest	151	26.4	30.7	26.9	14.6	7.0	13 Marg.(L&R), 7 Vert., 6 Cost.(L)
30-Sep-08	15915		2R9L	Nest	97	27.0	31.2	27.2	15.4	7.1	
30-Sep-08	15917		2R9L	Nest	97	27.4	30.8	27.1	16.0	7.3	6 Cost.(R), 5 Cost.(L)
30-Sep-08	15918		2R9L	Nest	97	26.6	31.5	27.6	16.2	7.3	
30-Sep-08	15920		2R9L	Nest	97	27.0	31.8	27.7	15.8	7.5	
30-Sep-08	15921	15922	2R9L	Nest	97	26.5	30.9	27.1	15.3	7.3	
30-Sep-08	15923		2R9L	Nest	97	27.4	32.3	27.5	15.9	7.5	
30-Sep-08	15925		2R9L	Nest	97	26.7	31.1	26.9	15.9	7.2	
1-Oct-08	15742	15743	2R9L	Nest	64	27.1	30.1	23.5	15.4	6.3	
1-Oct-08	15926	15927	2R9L	Nest	161	19.5	23.8	21.7	12.7	3.8	
1-Oct-08	15928		2R9L	Nest	64	27.3	31.4	26.6	15.5	6.6	
1-Oct-08	15929	15930	2R9L	Nest	64	28.1	31.3	26.4	15.8	6.8	
1-Oct-08	15931		2R9L	Nest	64	28.2	32.2	26.5	15.7	7.2	
1-Oct-08	15933		2R9L	Nest	64	26.5	30.2	25.7	14.5	6.3	
1-Oct-08	15934	15935	2R9L	Nest	64	25.4	29.3	24.6	14.6	6.1	
1-Oct-08	15936		2R9L	Nest	64	27.7	30.4	25.7	15.3	6.7	
1-Oct-08	15938		2R9L	Nest	64	25.2	29.6	24.8	15.1	6.4	
1-Oct-08	15939		2R9L	Nest	64	27.3	30.0	26.1	14.8	6.6	5 Cost.(R)
1-Oct-08	15941		2R9L	Nest	64	24.5	28.0	24.3	14.1	5.8	
1-Oct-08	15946		2R9L	Nest	153	29.3	33.3	30.1	15.9	8.7	
1-Oct-08	15947	15948	2R9L	Nest	153	28.2	31.3	27.9	15.5	7.4	
1-Oct-08	15949		2R9L	Nest	153	29.7	33.5	29.9	15.8	8.2	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
1-Oct-08	15951		2R9L	Nest	153	30.0	33.3	29.6	15.9	8.5	
1-Oct-08	15952	15953	2R9L	Nest	153	29.4	32.9	29.9	16.1	8.3	6 Vert., 5 Cost.(L)
1-Oct-08	15954		2R9L	Nest	153	30.2	33.5	29.8	16.1	8.9	
1-Oct-08	15955	15956	2R9L	Nest	153	26.4	29.8	26.7	14.2	6.1	
1-Oct-08	15957		2R9L	Nest	153	28.9	31.6	28.2	15.6	7.4	
1-Oct-08	15959		2R9L	Nest	153	30.1	33.3	29.4	16.1	8.6	
1-Oct-08	15960	15961	2R9L	Nest	153	27.2	30.6	28.2	15.5	7.6	Nuchal Divided
1-Oct-08	15962		2R9L	Nest	53	26.6	31.3	27.9	16.1	7.6	
1-Oct-08	15964		2R9L	Nest	53	25.8	30.1	27.3	14.9	6.0	
4-Oct-08	15965	15966	2R9L	Nest	161	20.5	25.0	21.9	12.8	4.1	8 Vert. (V3,4,5 divided), 6 Cost.(R), 13 Marg.(R&L)
7-Oct-08	15967		2R9L	Nest	217	26.4	27.1	27.1	17.1	8.0	10 Marg.(R) 11 Marg.(L), 3 Cost.(R&L) back knees do not bend(Stuck at 90deg)
7-Oct-08	15969		2R9L	Nest	111	29.1	30.6	27.8	16.5	7.3	
7-Oct-08	15970	15971	2R9L	Nest	111	29.2	32.3	28.2	16.1	7.8	Nuchal Divided
7-Oct-08	15972		2R9L	Nest	162	27.4	27.5	28.6	17.0	7.7	7 Vert., Left eye bulging out(looks like it will die)
7-Oct-08	15974		2R9L	Nest	162	28.4	31.2	28.3	15.1	8.0	5 Cost.(L), Nuchal Divided
7-Oct-08	15975		2R9L	Nest	162	27.7	31.9	28.1	16.3	7.9	
7-Oct-08	15977		2R9L	Nest	162	28.4	32.0	28.3	16.1	8.1	6 Vert., 5 Cost.(R)
7-Oct-08	15978	15979	2R9L	Nest	162	25.7	29.4	26.6	15.6	6.4	
7-Oct-08	15980		2R9L	Nest	162	26.6	30.4	26.7	15.4	6.8	
7-Oct-08	15982		2R9L	Nest	162	27.2	31.1	27.1	16.4	7.6	Nuchal Divided
7-Oct-08	15983	15984	2R9L	Nest	162	26.6	30.0	27.4	15.3	6.8	5 Cost.(R&L) 13 Marg.(L)
7-Oct-08	15985		2R9L	Nest	162	26.2	30.1	27.5	14.7	6.5	Nuchal Divided
7-Oct-08	15987		2R9L	Nest	162	25.5	29.8	26.2	14.7	6.3	6 Vert, 13 Marg.(R), 11 Marg.(L), Nuchal Divided
8-Oct-08	15988	15989	2R9L	Nest	64	26.0	29.4	24.3	15.1	5.9	
10-Oct-08	15990		2R9L	Nest	2	22.6	25.9	22.6	14.2	4.9	7 Vert., 13 Marg.(R), 3 Cost.(R)
15-Oct-08	15992		2R9L	Nest	161	21.1	25.0	23.2	13.1	3.9	
15-Oct-08	15993		2R9L	Nest	55	29.1	31.9	28.3	17.1	6.1	
3-Nov-08	15995		2R9L	Nest	88	30.0	33.0	28.2	16.9	8.6	
3-Nov-08	15997		2R9L	Nest	88	28.1	31.3	27.6	17.0	8.0	
3-Nov-08	15998	15999	2R9L	Nest	88	29.0	31.9	27.8	18.0	8.3	
3-Nov-08	16000		2R9L	Nest	7	27.8	31.2	27.8	15.6	7.8	
3-Nov-08	16001	16002	2R9L	Nest	7	27.5	31.2	27.4	15.5	7.2	
3-Nov-08	16003		2R9L	Nest	7	28.0	31.2	27.0	16.1	7.1	
3-Nov-08	16005		2R9L	Nest	7	29.1	32.1	28.5	15.4	7.6	
3-Nov-08	16006	16007	2R9L	Nest	72	26.4	29.9	27.1	16.3	6.9	
3-Nov-08	16008		2R9L	Nest	145	29.3	31.0	28.1	15.8	7.5	
3-Nov-08	16010		2R9L	Nest	145	29.3	31.0	28.5	15.8	7.6	Nuchal Divided
3-Nov-08	16013		2R9L	Nest	145	29.3	31.5	28.6	16.2	8.0	
3-Nov-08	16014	16015	2R9L	Nest	145	30.0	31.7	29.4	16.8	8.5	Nuchal Divided
3-Nov-08	16016		2R9L	Nest	145	29.1	31.1	29.8	15.5	7.7	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
3-Nov-08	16018		2R9L	Nest	145	29.4	31.8	28.4	16.2	7.9	
3-Nov-08	16019	16020	2R9L	Nest	145	30.1	32.5	29.3	16.5	8.1	
3-Nov-08	16021		2R9L	Nest	145	27.8	30.0	27.6	16.1	7.1	
3-Nov-08	16023		2R9L	Nest	145	30.8	32.5	29.3	15.3	8.4	
3-Nov-08	16024	16025	2R9L	Nest	145	30.3	32.0	29.2	16.4	8.1	
3-Nov-08	16026		2R9L	Nest	145	25.4	27.4	24.8	14.7	5.3	
3-Nov-08	16027	16028	2R9L	Nest	145	30.0	31.3	28.7	15.6	7.6	
3-Nov-08	16029		2R9L	Nest	145	25.3	28.1	25.9	14.5	5.4	
3-Nov-08	16031		2R9L	Nest	145	30.0	31.2	28.9	14.9	7.9	
3-Nov-08	16033	16034	2R9L	Nest	145	29.2	30.9	28.0	16.2	7.7	
17-Nov-08	16035		2R9L	Nest	157	28.4	30.7	26.8	15.0	7.4	Nuchal Divided
17-Nov-08	16036		2R9L	Nest	157	25.6	27.7	24.6	13.6	5.5	
17-Nov-08	16037		2R9L	Nest	157	28.8	32.4	28.4	15.5	8.0	
17-Nov-08	16039		2R9L	Nest	157	26.1	28.6	25.8	14.1	5.7	
17-Nov-08	16040		2R9L	Nest	157	27.8	31.1	27.6	15.4	7.5	
17-Nov-08	16042		2R9L	Nest	157	28.5	32.5	28.0	15.6	8.1	Nuchal Divided
17-Nov-08	16044		2R9L	Nest	157	27.8	31.6	28.2	15.5	8.1	Nuchal Divided
17-Nov-08	16045	16046	2R9L	Nest	157	28.0	31.3	27.3	15.2	7.6	Nuchal Divided
17-Nov-08	16047		2R9L	Nest	157	28.9	31.3	27.2	16.5	7.9	Nuchal Divided
24-Mar-09	16051		2R9L	Nest	95	29.9	34.5	29.0	16.1	8.2	pit tag in left hind leg
24-Mar-09	16052		2R9L	Nest	95	28.0	31.5	27.5	15.0	6.8	
24-Mar-09	16054		2R9L	Nest	95	28.2	32.1	27.8	14.5	7.7	eye infection left eye
24-Mar-09	16055	16056	2R9L	Nest	95	28.8	33.0	27.5	15.1	6.6	extrascute between 3rd anf 4th vertebral right side
24-Mar-09	16057		2R9L	Nest	95	29.6	31.7	27.0	15.6	7.0	growth under right eye & left top corner
24-Mar-09	16058	16059	2R9L	Nest	95	30.0	32.3	28.9	16.2	8.1	
24-Mar-09	16060	16061	2R9L	Nest	95	29.0	32.0	27.8	18.2	8.6	pit tag in left hind leg
24-Mar-09	16062		2R9L	Nest	95	29.1	31.8	27.8	16.0	8.0	pit tag in left hind leg
24-Mar-09	16063	16064	2R9L	Nest	95	28.1	32.7	28.3	15.0	8.1	16065 extra tag in left hind leg
24-Mar-09	16067		2R9L	Nest	95	28.3	32.0	28.9	15.0	8.0	nuchal scute split
24-Mar-09	16068	16069	2R9L	Nest	95	27.9	32.5	28.9	15.8	8.1	
24-Mar-09	16070		2R9L	Nest	95	28.0	31.6	28.5	15.7	7.8	nuchal scute split
24-Mar-09	16073	16074	2R9L	Nest	95	28.0	32.2	27.4	15.7	7.4	
24-Mar-09	16075		2R9L	Nest	95	28.0	32.5	28.7	15.7	7.9	
24-Mar-09	16077	16078	2R9L	Nest	95	28.1	31.7	27.0	16.9	8.1	
24-Mar-09	16079		2R9L	Nest	95	27.0	31.9	27.9	16.1	7.9	
24-Mar-09	16080		2R9L	Nest	dge of roa	27.7	30.2	26.1	15.6	7.3	
24-Mar-09	16081	16082	2R9L	Nest		27.2	29.8	25.3	15.6	6.6	
24-Mar-09	16083		2R9L	Nest		26.1	30.2	25.7	15.7	6.8	
24-Mar-09	16085		2R9L	Nest		26.4	29.1	25.4	15.7	6.6	
24-Mar-09	16086	16087	2R9L	Nest		25.6	30.0	25.8	15.6	6.3	
24-Mar-09	16088		2R9L	Nest		26.9	30.5	25.6	15.8	7.1	
24-Mar-09	16090		2R9L	Nest		26.3	29.9	25.9	15.4	6.7	
24-Mar-09	16091	16092	2R9L	Nest		25.4	29.4	24.5	15.2	6.2	
24-Mar-09	16093		2R9L	Nest		24.8	29.7	24.8	14.7	6.0	
25-Mar-09	16094	16095	2R9L	Nest	19	28.2	32.7	29.7	16.1	8.5	
25-Mar-09	16096		2R9L	Nest	19	28.2	32.4	29.2	16.1	8.3	
25-Mar-09	16098		2R9L	Nest	19	28.9	33.0	28.8	16.6	8.6	
25-Mar-09	16099	16100	2R9L	Nest	19	27.6	31.4	26.7	15.4	7.4	
25-Mar-09	16101		2R9L	Nest	19	24.6	28.4	23.5	14.1	5.5	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
25-Mar-09	16102	16103	2R9L	Nest	19	25.3	24.1	26.2	14.7	5.8	nuchal scute split & distended cloaca
25-Mar-09	16104		2R9L	Nest	19	21.8	26.0	22.6	13.4	4.4	
25-Mar-09	16106		2R9L	Nest	19	22.2	24.9	19.8	10.9	3.9	13 marginal nuchal split, 5 right costals and vertebrals
25-Mar-09	16107	16108	2R9L	Nest	19	28.3	31.6	28.3	16.4	7.6	wrong notch code 2R8L *
25-Mar-09	16109		2R9L	Nest	19	27.2	30.9	26.7	15.5	6.9	
30-Mar-09	16111		2R10R	Nest	85	27.7	32.2	27.4	15.2	7.3	
30-Mar-09	16113	16112	2R10R	Nest	85	26.4	30.7	26.9	14.8	5.3	
30-Mar-09	16114		2R10R	Nest	85	26.5	30.3	26.1	15.3	6.6	
30-Mar-09	16115	16116	2R10R	Nest	85	27.8	31.0	26.3	15.2	6.5	
30-Mar-09	16117		2R10R	Nest	85	26.8	30.2	27.0	14.9	6.6	
30-Mar-09	16119		2R10R	Nest	85	28.6	31.8	26.4	15.7	6.9	
30-Mar-09	16120	16121	2R10R	Nest	85	27.2	30.7	26.9	15.6	6.8	
30-Mar-09	16122		2R10R	Nest	85	26.5	30.6	25.9	16.1	6.1	
30-Mar-09	16124		2R10R	Nest	85	27.9	30.6	26.2	15.3	6.5	
30-Mar-09	16125	16126	2R10R	Nest	85	27.6	30.8	26.8	16.1	6.8	
30-Mar-09	16127		2R10R	Nest	85	26.6	30.2	25.8	15.0	6.2	
30-Mar-09	16128	16129	2R10R	Nest	85	28.5	31.7	27.2	15.6	7.3	
30-Mar-09	16130		2R10R	Nest	10	29.4	32.0	29.8	14.3	7.2	
30-Mar-09	16132		2R10R	Nest	10	27.6	30.9	28.2	16.0	6.8	
30-Mar-09	16133	16134	2R10R	Nest	10	28.9	32.1	29.0	15.4	6.9	
30-Mar-09	16135		2R10R	Nest	10	28.9	31.5	28.1	15.3	7.0	
30-Mar-09	16137		2R10R	Nest	10	28.5	31.8	27.7	15.4	7.3	
30-Mar-09	16138		2R10R	Nest	10	29.2	31.9	29.0	15.4	7.0	
30-Mar-09	16140		2R10R	Nest	10	28.6	31.1	28.5	15.6	7.2	26 marginals
30-Mar-09	16141	16142	2R10R	Nest	10	30.3	32.5	28.5	16.6	7.9	
30-Mar-09	16143		2R10R	Nest	10	29.7	32.4	29.3	16.3	8.0	
30-Mar-09	16145		2R10R	Nest	10	29.3	32.1	28.8	16.0	7.3	
30-Mar-09	16146	16147	2R10R	Nest	10	27.9	30.5	28.1	15.5	7.0	
30-Mar-09	16148		2R10R	Nest	75	27.5	30.5	27.1	16.3	7.0	
30-Mar-09	16150		2R10R	Nest	75	25.7	29.0	24.7	15.6	5.8	
30-Mar-09	16151	16152	2R10R	Nest	75	25.2	29.0	26.1	15.2	5.9	
30-Mar-09	16153		2R10R	Nest	75	26.1	28.8	26.5	15.0	6.1	
30-Mar-09	16155		2R10R	Nest	75	26.1	29.1	26.2	14.7	5.9	
30-Mar-09	16156		2R10R	Nest	75	24.3	27.6	25.2	14.6	5.3	
30-Mar-09	16158		2R10R	Nest	75	25.9	28.4	26.5	15.2	6.0	
30-Mar-09	16160		2R10R	Nest	75	24.9	28.2	25.3	14.3	5.2	
30-Mar-09	16161		2R10R	Nest	75	24.5	27.0	25.4	15.1	5.5	
30-Mar-09	16163		2R10R	Nest	75	25.0	29.0	25.8	15.2	6.1	
30-Mar-09	16164		2R10R	Nest	75	25.0	28.7	25.7	15.2	6.1	
30-Mar-09	16166		2R10R	Nest	75	25.2	28.3	26.0	14.4	5.7	
30-Mar-09	16168		2R10R	Nest	75	25.9	28.3	24.9	15.3	6.1	
30-Mar-09	16169		2R10R	Nest	53	28.1	32.0	28.2	15.6	8.0	anomalous V5
30-Mar-09	16171		2R10R	Nest	53	29.8	31.9	28.7	15.5	7.9	anomalous V5
30-Mar-09	16173		2R10R	Nest	53	27.9	30.7	26.3	15.4	6.5	anomalous V5, anomalous left and right costals
30-Mar-09	16174	16175	2R10R	Nest	53	28.3	31.3	27.8	15.5	7.4	
30-Mar-09	16176		2R10R	Nest	53	28.9	32.3	28.1	15.7	7.9	26 marginals, anomalous V5

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16178		2R10R	Nest	53	27.7	32.3	28.1	15.9	7.7	anomalous V5
30-Mar-09	16179		2R10R	Nest	53	29.1	31.9	28.8	16.5	8.2	anomalous V5
30-Mar-09	16181		2R10R	Nest	53	29.0	31.6	29.7	15.6	7.8	
30-Mar-09	16182	16183	2R10R	Nest	53	29.1	32.1	27.6	15.8	7.8	
30-Mar-09	16184		2R10R	Nest	53	29.2	32.4	28.8	15.7	8.1	
30-Mar-09	16186		2R10R	Nest	53	29.0	31.8	29.5	15.2	8.0	
30-Mar-09	16188		2R10R	Nest	53	28.3	32.1	29.3	14.8	7.6	
30-Mar-09	16189		2R10R	Nest	53	27.8	31.4	28.8	16.0	8.1	anomalous V5
30-Mar-09	16191		2R10R	Nest	136	28.7	31.7	28.5	16.6	8.0	
30-Mar-09	16193		2R10R	Nest	136	28.3	31.9	29.6	16.6	8.0	anomalous V5
30-Mar-09	16194		2R10R	Nest	136	27.3	31.5	27.7	15.6	6.9	
30-Mar-09	16196		2R10R	Nest	136	29.0	32.6	28.3	16.9	7.9	
30-Mar-09	16197	16198	2R10R	Nest	136	30.0	32.8	29.1	16.7	8.2	
30-Mar-09	16199		2R10R	Nest	136	27.2	30.8	27.6	15.6	6.9	
30-Mar-09	16201		2R10R	Nest	136	28.4	32.0	28.5	16.9	7.8	anomalous V5
30-Mar-09	16202		2R10R	Nest	136	28.4	30.1	28.5	16.4	7.6	
30-Mar-09	16204		2R10R	Nest	136	27.6	31.2	28.6	15.2	6.9	
30-Mar-09	16206		2R10R	Nest	136	29.4	32.8	29.0	17.3	8.1	
30-Mar-09	16207		2R10R	Nest	136	27.3	31.1	28.3	15.7	7.2	
30-Mar-09	16209		2R10R	Nest	165	28.0	31.5	28.4	15.6	7.2	
30-Mar-09	16210	16211	2R10R	Nest	165	27.8	31.5	27.6	15.9	7.2	
30-Mar-09	16212		2R10R	Nest	165	23.9	27.2	24.9	15.3	5.1	anomalous V3, 22 marginals
30-Mar-09	16214		2R10R	Nest	165	23.3	25.6	23.3	13.1	4.0	
30-Mar-09	16215	16216	2R10R	Nest	165	29.4	32.8	28.4	16.8	8.2	
30-Mar-09	16217		2R10R	Nest	165	28.8	31.8	28.1	16.6	7.9	
30-Mar-09	16219		2R10R	Nest	165	23.8	26.2	23.8	13.7	4.5	anomalous V5
30-Mar-09	16220		2R10R	Nest	165	28.8	31.0	28.9	16.5	7.8	anomalous V5
30-Mar-09	16222		2R10R	Nest	165	25.4	29.9	24.9	14.8	6.0	anomalous V5, 26 marginals
30-Mar-09	16224		2R10R	Nest	76	29.3	33.0	28.8	16.7	8.2	
30-Mar-09	16226		2R10R	Nest	76	29.4	32.3	28.6	16.2	7.7	
30-Mar-09	16227		2R10R	Nest	76	28.7	31.7	28.7	15.9	7.6	anomalous R costal
30-Mar-09	16228	16229	2R10R	Nest	76	28.4	31.9	28.6	16.8	8.0	
30-Mar-09	16230		2R10R	Nest	76	29.1	33.2	29.0	17.4	8.2	
30-Mar-09	16232		2R10R	Nest	76	27.4	32.0	29.0	16.0	7.2	
30-Mar-09	16233	16234	2R10R	Nest	76	29.1	32.3	28.5	17.0	7.6	
30-Mar-09	16235		2R10R	Nest	76	29.5	32.5	28.3	17.0	8.2	
30-Mar-09	16237		2R10R	Nest	76	28.9	32.6	29.4	16.3	8.0	
30-Mar-09	16238		2R10R	Nest	76	28.6	31.8	29.6	17.2	8.3	
30-Mar-09	16240		2R10R	Nest	110	28.6	31.4	28.5	16.9	7.3	
30-Mar-09	16241	16242	2R10R	Nest	110	28.8	30.3	28.0	16.3	7.6	
30-Mar-09	16243		2R10R	Nest	110	29.3	32.3	30.3	16.2	8.6	
30-Mar-09	16245		2R10R	Nest	110	28.1	31.1	28.2	16.9	7.6	
30-Mar-09	16246	16247	2R10R	Nest	110	25.0	28.3	26.6	15.2	5.9	
30-Mar-09	16248		2R10R	Nest	110	24.8	27.4	26.0	14.4	5.3	
30-Mar-09	16250		2R10R	Nest	110	30.0	31.8	29.9	17.1	8.4	
30-Mar-09	16253		2R10R	Nest	110	29.1	31.9	29.0	16.3	7.8	
30-Mar-09	16255		2R10R	Nest	110	29.1	31.6	28.2	17.0	8.4	
30-Mar-09	16256		2R10R	Nest	110	26.5	28.7	26.2	16.3	5.9	
30-Mar-09	16258		2R10R	Nest	110	25.1	27.8	25.5	13.8	5.4	
30-Mar-09	16259	16260	2R10R	Nest	110	28.9	31.7	28.3	16.1	7.6	
30-Mar-09	16261		2R10R	Nest	182	26.0	29.1	26.5	15.1	6.7	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16263		2R10R	Nest	182	26.2	29.4	26.2	16.2	7.4	
30-Mar-09	16264		2R10R	Nest	182	27.4	30.1	26.6	15.5	7.3	
30-Mar-09	16266		2R10R	Nest	182	27.3	31.6	26.7	16.0	7.8	
30-Mar-09	16267	16268	2R10R	Nest	182	25.3	27.9	25.3	14.0	6.0	
30-Mar-09	16269		2R10R	Nest	182	23.6	27.4	24.5	14.8	5.9	
30-Mar-09	16271		2R10R	Nest	182	24.9	28.4	24.6	14.8	5.5	
30-Mar-09	16272	16273	2R10R	Nest	182	25.3	29.2	25.4	14.4	6.4	
30-Mar-09	16274		2R10R	Nest	182	24.8	28.7	24.8	14.9	5.8	
30-Mar-09	16276		2R10R	Nest	182	27.0	30.7	25.9	15.8	7.3	26 marginals
30-Mar-09	16277		2R10R	Nest	176	28.5	31.7	30.0	16.1	8.1	
30-Mar-09	16279		2R10R	Nest	176	27.6	31.2	28.8	15.0	7.4	anomalous V4
30-Mar-09	16280	16281	2R10R	Nest	176	27.3	31.6	28.6	16.2	8.1	
30-Mar-09	16282		2R10R	Nest	176	28.3	31.0	29.3	15.6	7.9	
30-Mar-09	16284		2R10R	Nest	176	27.9	32.5	29.2	15.5	7.7	anomalous V5
30-Mar-09	16285		2R10R	Nest	176	29.1	31.5	29.0	16.5	8.2	
30-Mar-09	16287		2R10R	Nest	176	25.2	28.6	25.7	15.6	5.9	
30-Mar-09	16289		2R10R	Nest	176	27.6	32.6	29.8	15.6	8.2	
30-Mar-09	16290		2R10R	Nest	176	24.2	27.3	24.9	13.8	5.0	
30-Mar-09	16292		2R10R	Nest	176	25.8	29.2	27.0	15.3	6.4	
30-Mar-09	16293	16294	2R10R	Nest	176	21.8	24.0	18.8	13.8	3.7	anomalous V5, damage 9,10,11 R
30-Mar-09	16295		2R10R	Nest	137	28.5	31.1	27.7	16.4	7.0	
30-Mar-09	16297		2R10R	Nest	137	29.4	32.1	28.5	15.7	7.4	
30-Mar-09	16298		2R10R	Nest	137	29.9	32.2	28.9	16.1	7.9	
30-Mar-09	16300		2R10R	Nest	137	29.2	32.6	29.1	15.3	7.7	
30-Mar-09	16301	16302	2R10R	Nest	137	28.8	31.4	28.3	15.9	7.3	
30-Mar-09	16303		2R10R	Nest	137	29.1	31.1	28.1	15.7	7.1	
30-Mar-09	16305		2R10R	Nest	137	29.2	32.4	28.4	16.4	7.7	anomalous V5
30-Mar-09	16306	16307	2R10R	Nest	137	28.2	31.9	28.8	16.5	7.3	
30-Mar-09	16308		2R10R	Nest	137	29.3	32.0	27.9	15.9	7.7	
30-Mar-09	16310		2R10R	Nest	137	28.5	31.4	27.9	15.6	7.1	
30-Mar-09	16311	16312	2R10R	Nest	137	28.1	31.6	28.3	15.8	7.1	
30-Mar-09	16313		2R10R	Nest	137	28.5	32.5	28.7	15.6	7.3	
30-Mar-09	16315		2R10R	Nest	137	29.0	32.4	28.3	16.0	7.5	
30-Mar-09	16316		2R10R	Nest	84	27.2	31.7	27.6	16.4	7.4	
30-Mar-09	16318		2R10R	Nest	84	28.4	31.5	28.9	15.9	7.9	
30-Mar-09	16320		2R10R	Nest	84	28.3	32.2	30.2	16.1	8.1	
30-Mar-09	16321		2R10R	Nest	84	29.6	32.7	28.1	17.3	8.5	
30-Mar-09	16322		2R10R	Nest	84	29.4	32.0	28.8	16.1	7.7	
30-Mar-09	16324	16325	2R10R	Nest	84	27.4	30.5	26.0	15.8	6.6	
30-Mar-09	16326		2R10R	Nest	84	28.8	32.5	29.0	16.4	8.2	
30-Mar-09	16327	16328	2R10R	Nest	84	29.3	33.1	28.1	17.9	8.4	
30-Mar-09	16329		2R10R	Nest	84	29.6	33.2	28.9	16.9	8.1	
30-Mar-09	16331		2R10R	Nest	84	29.4	33.0	28.5	16.7	8.0	
30-Mar-09	16332	16333	2R10R	Nest	84	29.2	32.2	28.8	16.5	8.4	
30-Mar-09	16334		2R10R	Nest	84	29.2	31.9	28.6	17.1	8.2	
30-Mar-09	16336		2R10R	Nest	21	26.0	30.3	27.1	15.4	6.3	
30-Mar-09	16338		2R10R	Nest	106	29.5	31.8	28.5	15.5	7.0	
30-Mar-09	16339		2R10R	Nest	106	26.5	28.7	25.7	14.5	5.8	anomalous costal 1 V
30-Mar-09	16341		2R10R	Nest	106	29.4	32.0	28.7	15.5	7.2	
30-Mar-09	16342	16343	2R10R	Nest	106	27.2	29.3	26.4	14.5	5.8	
30-Mar-09	16344		2R10R	Nest	106	28.5	30.9	28.8	15.3	7.4	
30-Mar-09	16346		2R10R	Nest	106	27.9	30.1	26.0	15.8	6.2	anomalous V5

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16347	16348	2R10R	Nest	106	29.7	32.2	28.6	14.1	7.4	
30-Mar-09	16349		2R10R	Nest	106	31.3	33.7	29.5	14.3	7.8	anomalous V4, V5
30-Mar-09	16350	16351	2R10R	Nest	106	30.0	32.2	28.4	15.8	7.6	
30-Mar-09	16352		2R10R	Nest	106	31.5	34.0	30.3	17.3	8.7	
30-Mar-09	16354		2R10R	Nest	106	27.3	29.8	26.7	14.4	6.0	
30-Mar-09	16356		2R10R	Nest	106	29.0	30.4	28.8	15.0	7.3	anomalous V4
30-Mar-09	16357	16358	2R10R	Nest	106	29.6	30.8	29.4	15.8	7.2	
30-Mar-09	16359		2R10R	Nest	58	27.9	31.7	29.4	16.2	7.5	
30-Mar-09	16361		2R10R	Nest	58	27.9	32.3	30.1	16.7	7.8	
30-Mar-09	16362		2R10R	Nest	58	28.2	31.8	28.9	16.6	7.7	anomalous V5
30-Mar-09	16364		2R10R	Nest	58	28.5	31.8	29.2	16.3	7.7	
30-Mar-09	16365	16366	2R10R	Nest	58	27.6	31.1	29.8	15.9	7.8	
30-Mar-09	16367		2R10R	Nest	58	27.9	31.6	28.7	16.5	7.8	
30-Mar-09	16369		2R10R	Nest	58	27.2	30.1	29.1	16.4	7.3	
30-Mar-09	16370	16371	2R10R	Nest	58	27.7	32.8	29.3	16.7	7.5	
30-Mar-09	16372		2R10R	Nest	58	28.3	31.3	29.4	16.9	8.0	
30-Mar-09	16374		2R10R	Nest	58	27.7	31.4	28.7	16.9	7.6	
30-Mar-09	16375	16376	2R10R	Nest	58	28.4	32.0	29.9	15.8	7.5	
30-Mar-09	16377		2R10R	Nest	179	25.8	28.6	26.2	15.1	6.0	
30-Mar-09	16378	16379	2R10R	Nest	179	24.9	28.5	26.7	15.5	6.4	
30-Mar-09	16380		2R10R	Nest	179	25.7	28.8	26.4	15.3	6.0	
30-Mar-09	16382		2R10R	Nest	179	26.2	29.4	27.4	16.2	6.7	
30-Mar-09	16383	16384	2R10R	Nest	179	26.2	27.8	26.6	14.5	6.2	
30-Mar-09	16385		2R10R	Nest	179	24.4	26.9	25.7	14.7	5.8	
30-Mar-09	16387		2R10R	Nest	179	25.5	28.3	27.3	15.4	6.4	VBVB
30-Mar-09	16388		2R10R	Nest	179	24.4	28.0	25.1	14.4	5.6	anomalous V1
30-Mar-09	16390		2R10R	Nest	179	25.6	27.8	27.3	15.0	6.4	anomalous V5
30-Mar-09	16391	16392	2R10R	Nest	179	24.8	27.4	25.2	14.0	5.5	
30-Mar-09	16393		2R10R	Nest	179	25.0	28.1	26.7	15.1	6.3	
30-Mar-09	16395		2R10R	Nest	179	26.3	28.8	26.1	14.6	6.0	anomalous V5
30-Mar-09	16396	16397	2R10R	Nest	179	26.8	30.1	26.7	15.6	6.9	
30-Mar-09	16398		2R10R	Nest	179	25.8	28.6	26.4	14.8	6.3	
30-Mar-09	16400		2R10R	Nest	179	22.8	26.3	25.3	15.2	5.3	
30-Mar-09	16401	16402	2R10R	Nest	63	27.6	31.0	28.7	16.7	7.6	
30-Mar-09	16403		2R10R	Nest	63	27.9	32.3	28.6	16.6	7.6	
30-Mar-09	16405		2R10R	Nest	63	28.5	31.7	28.7	16.2	7.7	
30-Mar-09	16406		2R10R	Nest	63	28.2	32.1	28.7	16.3	7.4	
30-Mar-09	16408		2R10R	Nest	63	27.5	31.1	27.8	16.0	7.0	
30-Mar-09	16409	16410	2R10R	Nest	63	27.4	31.1	27.7	15.3	7.3	
30-Mar-09	16411		2R10R	Nest	63	28.6	32.1	28.7	16.2	7.4	anomalous V5
30-Mar-09	16413		2R10R	Nest	63	28.0	31.6	29.3	16.1	7.6	
30-Mar-09	16414	16415	2R10R	Nest	63	28.1	30.1	28.3	16.5	7.5	
30-Mar-09	16416		2R10R	Nest	63	27.6	31.3	28.0	16.2	7.1	anomalous V5
30-Mar-09	16418		2R10R	Nest	63	28.2	31.6	28.3	15.7	7.3	anomalous V5
30-Mar-09	16419	16420	2R10R	Nest	63	28.1	31.7	27.9	16.6	7.3	
30-Mar-09	16421		2R10R	Nest	139	28.5	31.4	28.0	15.3	7.3	26 marginals
30-Mar-09	16423		2R10R	Nest	139	27.1	29.6	27.3	15.7	6.8	
30-Mar-09	16424		2R10R	Nest	139	27.5	30.6	27.8	16.3	7.2	
30-Mar-09	16426		2R10R	Nest	139	28.4	32.6	27.4	16.2	7.6	anomalous V5
30-Mar-09	16428		2R10R	Nest	139	28.5	30.1	26.7	16.1	7.2	
30-Mar-09	16429		2R10R	Nest	139	27.6	30.5	27.1	15.9	6.9	anomalous V5
30-Mar-09	16431		2R10R	Nest	139	28.2	31.6	27.1	15.0	7.3	
30-Mar-09	16432	16433	2R10R	Nest	139	28.2	31.8	27.4	16.1	7.3	anomalous V5

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16434		2R10R	Nest	139	28.0	31.3	27.3	16.3	7.4	
30-Mar-09	16436		2R10R	Nest	139	28.4	31.0	27.8	17.0	7.5	
30-Mar-09	16437	16438	2R10R	Nest	139	26.4	28.0	26.4	17.2	6.8	anomalous V1
30-Mar-09	16439		2R10R	Nest	139	27.9	30.8	26.5	15.4	7.1	anomalous V4, V5
30-Mar-09	16441		2R10R	Nest	139	28.2	30.0	26.6	16.3	7.2	13 marginals on right
30-Mar-09	16442		2R10R	Nest	156	30.0	32.7	30.0	16.3	8.6	
30-Mar-09	16444		2R10R	Nest	156	30.6	33.9	31.2	16.2	9.1	
30-Mar-09	16446	16445	2R10R	Nest	156	27.0	30.1	27.1	16.1	7.4	
30-Mar-09	16447		2R10R	Nest	156	25.3	28.9	26.1	14.1	5.8	
30-Mar-09	16449		2R10R	Nest	156	31.1	33.9	29.2	17.2	9.5	
30-Mar-09	16450		2R10R	Nest	156	27.3	29.7	27.4	15.2	6.4	
30-Mar-09	16452		2R10R	Nest	156	30.4	33.0	29.7	16.1	8.5	
30-Mar-09	16454		2R10R	Nest	156	30.5	33.9	30.2	16.4	9.1	
30-Mar-09	16456	16455	2R10R	Nest	156	27.8	31.4	28.5	15.9	7.6	
30-Mar-09	16457		2R10R	Nest	156	29.2	32.7	29.6	16.0	8.4	
30-Mar-09	16459		2R10R	Nest	156	30.3	33.6	25.9	16.3	8.7	
30-Mar-09	16460		2R10R	Nest	177	25.0	27.4	24.3	15.0	5.7	
30-Mar-09	16462		2R10R	Nest	177	25.9	28.3	25.5	15.0	5.5	
30-Mar-09	16463	16464	2R10R	Nest	177	21.0	23.6	19.7	13.3	3.3	
30-Mar-09	16465		2R10R	Nest	177	25.7	26.3	23.6	15.3	5.3	
30-Mar-09	16467		2R10R	Nest	27	28.5	32.3	29.4	16.8	8.1	
30-Mar-09	16468	16469	2R10R	Nest	27	28.0	31.3	28.3	15.9	7.1	
30-Mar-09	16470		2R10R	Nest	27	28.3	31.7	29.3	16.2	7.8	
30-Mar-09	16472		2R10R	Nest	27	28.6	30.6	27.7	16.2	7.2	anomalous V4, V5;13 marginals on R
30-Mar-09	16473	16474	2R10R	Nest	27	28.3	31.2	27.5	16.4	7.3	
30-Mar-09	16475		2R10R	Nest	27	28.5	31.6	27.8	16.7	7.6	anomalous V1
30-Mar-09	16477		2R10R	Nest	27	26.7	31.2	27.8	16.0	7.0	
30-Mar-09	16478		2R10R	Nest	27	28.2	30.7	27.9	16.0	7.0	
30-Mar-09	16480		2R10R	Nest	27	27.9	31.5	28.0	16.3	7.5	
30-Mar-09	16482		2R10R	Nest	27	27.4	31.4	27.3	15.7	7.2	
30-Mar-09	16483		2R10R	Nest	65	27.7	31.4	27.7	16.3	7.2	
30-Mar-09	16485		2R10R	Nest	65	27.8	31.7	28.3	17.1	7.7	
30-Mar-09	16486	16487	2R10R	Nest	65	28.3	31.5	27.8	17.0	7.7	
30-Mar-09	16488		2R10R	Nest	65	26.6	30.1	26.1	16.1	6.2	
30-Mar-09	16490		2R10R	Nest	65	26.5	31.3	27.8	16.6	7.1	
30-Mar-09	16491		2R10R	Nest	65	28.5	31.9	28.2	17.0	7.7	
30-Mar-09	16493		2R10R	Nest	65	28.1	31.9	28.0	16.8	7.7	
30-Mar-09	16495		2R10R	Nest	65	25.6	27.9	23.7	15.6	6.8	
30-Mar-09	16496		2R10R	Nest	65	28.5	31.1	28.5	16.8	7.7	
30-Mar-09	16498		2R10R	Nest	65	28.0	31.8	27.5	17.2	7.2	anomalous V1
30-Mar-09	16500		2R10R	Nest	65	27.8	31.2	27.4	16.5	7.8	
30-Mar-09	16503		2R10R	Nest	112	26.8	30.3	26.9	16.4	7.2	
30-Mar-09	16504	16505	2R10R	Nest	112	27.9	31.2	26.7	16.2	6.9	
30-Mar-09	16506		2R10R	Nest	112	27.5	31.7	27.6	16.8	7.4	
30-Mar-09	16508		2R10R	Nest	112	27.0	30.1	27.0	16.1	6.5	
30-Mar-09	16509	16510	2R10R	Nest	112	27.9	31.2	28.1	17.6	7.6	
30-Mar-09	16511		2R10R	Nest	112	26.9	30.5	27.3	16.9	7.3	
30-Mar-09	16513		2R10R	Nest	112	26.3	30.7	26.7	16.3	7.1	
30-Mar-09	16514		2R10R	Nest	112	27.2	31.9	27.7	16.7	7.4	
30-Mar-09	16516		2R10R	Nest	112	27.6	31.2	27.2	17.2	7.6	
30-Mar-09	16518		2R10R	Nest	112	26.2	29.1	26.7	16.2	6.3	
30-Mar-09	16519		2R10R	Nest	112	27.2	31.4	27.8	16.6	7.7	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16521		2R10R	Nest	112	27.6	31.6	27.7	15.9	7.4	anomalous V1
30-Mar-09	16522	16523	2R10R	Nest	112	27.6	31.0	26.8	17.0	6.7	
30-Mar-09	16524		2R10R	Nest	112	27.7	32.0	27.5	17.1	7.8	
30-Mar-09	16526		2R10R	Nest	173	26.8	29.4	26.3	15.3	6.4	anomalous V5
30-Mar-09	16527	16528	2R10R	Nest	173	30.3	32.7	27.6	16.3	7.9	
30-Mar-09	16529		2R10R	Nest	173	30.1	33.3	29.3	17.0	8.6	
30-Mar-09	16531		2R10R	Nest	173	31.0	32.7	29.1	16.3	8.6	
30-Mar-09	16532	16533	2R10R	Nest	173	27.3	29.9	26.6	15.7	6.4	
30-Mar-09	16534		2R10R	Nest	173	27.6	29.3	26.9	15.5	6.7	
30-Mar-09	16536		2R10R	Nest	173	29.6	30.7	27.2	15.1	7.1	
30-Mar-09	16537		2R10R	Nest	173	30.1	32.5	28.7	17.2	8.3	13 marginal R side
30-Mar-09	16539		2R10R	Nest	173	28.9	30.5	26.9	16.1	7.1	anomalous V5; 13 marginals R side
30-Mar-09	16541		2R10R	Nest	3	25.9	28.0	25.4	15.0	5.4	anomalous V5
30-Mar-09	16542		2R10R	Nest	3	27.3	29.1	27.1	16.2	6.2	
30-Mar-09	16544		2R10R	Nest	3	26.6	29.2	27.8	16.7	6.6	
30-Mar-09	16545	16546	2R10R	Nest	3	26.1	28.1	26.8	15.0	5.8	
30-Mar-09	16547		2R10R	Nest	172	26.8	29.8	25.8	15.1	6.4	
30-Mar-09	16549		2R10R	Nest	172	27.1	30.0	28.1	16.9	7.7	anomalous V5
30-Mar-09	16550	16551	2R10R	Nest	172	28.2	31.8	28.5	16.9	8.1	
30-Mar-09	16552		2R10R	Nest	172	25.6	28.4	25.5	15.3	6.0	
30-Mar-09	16554		2R10R	Nest	172	27.0	29.9	26.9	16.2	6.7	
30-Mar-09	16555	16556	2R10R	Nest	172	26.3	28.7	26.1	15.8	6.4	
30-Mar-09	16557		2R10R	Nest	172	28.5	30.7	26.5	16.6	7.1	anomalous V4, V5
30-Mar-09	16559		2R10R	Nest	172	29.2	31.3	26.9	18.0	7.9	
30-Mar-09	16560		2R10R	Nest	172	26.6	29.3	27.2	16.3	7.1	anomalous V5
30-Mar-09	16562		2R10R	Nest	172	27.0	29.8	26.6	16.4	7.1	anomalous V5
30-Mar-09	16564		2R10R	Nest	172	25.0	28.3	26.2	14.4	6.0	anomalous V4, V5
30-Mar-09	16565		2R10R	Nest	172	25.1	28.7	25.1	14.9	5.5	
30-Mar-09	16567		2R10R	Nest	172	26.8	29.4	25.1	15.9	6.5	
30-Mar-09	16568	16569	2R10R	Nest	172	27.0	29.9	27.2	15.8	7.0	anomalous V5
30-Mar-09	16570		2R10R	Nest	172	28.8	31.7	27.9	15.9	7.9	
30-Mar-09	16572		2R10R	Nest	172	27.3	29.0	25.5	16.3	6.8	anomalous V5
30-Mar-09	16573	16574	2R10R	Nest	60	25.6	33.5	29.1	16.0	8.3	
30-Mar-09	16575		2R10R	Nest	60	29.4	33.8	28.5	18.2	8.6	
30-Mar-09	16577		2R10R	Nest	60	28.4	31.4	29.2	16.4	8.2	
30-Mar-09	16578		2R10R	Nest	60	29.1	31.5	29.4	16.2	8.1	
30-Mar-09	16580		2R10R	Nest	60	29.6	32.4	29.1	16.5	9.0	
30-Mar-09	16582		2R10R	Nest	60	29.6	32.9	27.9	16.7	8.1	
30-Mar-09	16583		2R10R	Nest	60	30.2	33.6	29.6	16.2	8.6	
30-Mar-09	16585		2R10R	Nest	60	29.0	32.4	28.4	17.5	8.2	
30-Mar-09	16587		2R10R	Nest	60	27.7	31.5	28.0	16.4	7.9	
30-Mar-09	16588		2R10R	Nest	174	27.5	30.9	27.4	16.2	7.3	
30-Mar-09	16590		2R10R	Nest	174	23.5	25.4	22.5	12.8	4.1	anomalous V5
30-Mar-09	16592		2R10R	Nest	174	23.5	26.7	23.7	14.5	4.6	
30-Mar-09	16593		2R10R	Nest	174	24.6	27.1	25.1	13.7	5.3	
30-Mar-09	16595		2R10R	Nest	174	26.8	29.5	27.3	15.4	6.9	
30-Mar-09	16596	15597	2R10R	Nest	174	23.4	27.1	23.9	14.1	4.7	
30-Mar-09	16598		2R10R	Nest	90	28.8	30.5	27.2	16.1	7.1	anomalous V5
30-Mar-09	16600		2R10R	Nest	90	30.4	32.5	29.2	17.4	8.0	anomalous V5
30-Mar-09	16602		2R10R	Nest	90	29.1	31.4	28.1	16.0	7.4	
30-Mar-09	16603		2R10R	Nest	90	29.5	32.2	28.2	17.3	7.7	
30-Mar-09	16605		2R10R	Nest	90	27.8	30.0	27.2	16.3	6.8	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16606		2R10R	Nest	90	29.0	30.9	28.2	16.7	7.8	
30-Mar-09	16608		2R10R	Nest	90	28.3	30.5	26.9	16.2	6.6	
30-Mar-09	16609	16610	2R10R	Nest	90	29.0	32.4	28.4	16.8	7.7	
30-Mar-09	16611		2R10R	Nest	90	29.2	32.3	28.2	16.2	7.7	
30-Mar-09	16613		2R10R	Nest	90	28.6	31.2	29.1	17.7	7.9	
30-Mar-09	16614	16615	2R10R	Nest	90	29.2	31.0	26.6	16.0	6.9	
30-Mar-09	16616		2R10R	Nest	90	29.6	31.6	27.6	16.0	7.6	
30-Mar-09	16618		2R10R	Nest	90	28.9	31.4	28.2	16.3	7.5	
30-Mar-09	16619		2R10R	Nest	90	28.8	31.3	28.1	16.1	7.4	
30-Mar-09	16621		2R10R	Nest	90	28.4	30.7	29.3	15.9	7.8	
30-Mar-09	16622	16623	2R10R	Nest	90	29.1	31.8	28.5	16.5	7.7	
30-Mar-09	16624		2R10R	Nest	125	28.4	30.9	25.9	15.7	6.2	
30-Mar-09	16626		2R10R	Nest	125	28.1	30.1	26.1	16.0	6.6	
30-Mar-09	16627	16628	2R10R	Nest	125	29.4	32.6	27.8	16.4	7.6	
30-Mar-09	16629		2R10R	Nest	125	29.5	31.6	27.3	15.7	7.3	
30-Mar-09	16631		2R10R	Nest	125	28.3	31.0	28.5	15.9	6.7	
30-Mar-09	16632		2R10R	Nest	125	29.5	31.9	28.0	15.9	7.5	
30-Mar-09	16634		2R10R	Nest	125	28.5	31.4	26.6	16.1	7.0	
30-Mar-09	16636		2R10R	Nest	125	28.3	31.5	27.1	15.3	6.8	
30-Mar-09	16637		2R10R	Nest	125	27.8	30.1	26.9	15.8	6.7	anomalous V5
30-Mar-09	16639		2R10R	Nest	125	27.7	30.1	26.4	14.6	6.2	
30-Mar-09	16640	16641	2R10R	Nest	33	27.1	30.2	27.9	16.1	7.1	
30-Mar-09	16643		2R10R	Nest	33	26.6	30.4	27.8	14.8	6.1	
30-Mar-09	16644		2R10R	Nest	33	27.0	30.9	27.5	15.1	6.8	anomalous V3
30-Mar-09	16645	16646	2R10R	Nest	33	26.5	30.4	27.1	15.1	6.6	
30-Mar-09	16647		2R10R	Nest	33	27.0	30.2	28.2	14.4	6.6	
30-Mar-09	16649		2R10R	Nest	33	26.2	29.7	28.2	15.2	6.7	
30-Mar-09	16650	16651	2R10R	Nest	33	27.8	30.2	27.9	15.4	7.0	
30-Mar-09	16652		2R10R	Nest	33	27.4	30.2	27.2	15.5	6.2	
30-Mar-09	16653	16654	2R10R	Nest	33	26.5	30.2	27.3	15.6	6.8	
30-Mar-09	16655		2R10R	Nest	70	29.1	32.1	28.2	16.3	7.7	
30-Mar-09	16657		2R10R	Nest	70	27.9	31.0	27.5	16.7	6.9	anomalous V4, V5
30-Mar-09	16658	16659	2R10R	Nest	70	27.8	30.6	26.6	16.3	6.6	
30-Mar-09	16660		2R10R	Nest	70	28.3	32.5	27.4	15.9	7.3	
30-Mar-09	16662		2R10R	Nest	70	27.7	31.3	27.8	16.0	7.2	
30-Mar-09	16663		2R10R	Nest	70	26.1	29.6	26.8	16.3	6.6	
30-Mar-09	16665		2R10R	Nest	70	29.2	31.5	28.3	15.6	7.0	
30-Mar-09	16666	16667	2R10R	Nest	70	27.7	31.8	27.5	16.2	7.3	
30-Mar-09	16668		2R10R	Nest	70	28.6	31.9	26.3	16.2	7.1	
30-Mar-09	16670		2R10R	Nest	70	27.0	30.8	27.2	16.6	7.1	
30-Mar-09	16672		2R10R	Nest	96	26.2	29.2	25.4	15.2	5.8	
30-Mar-09	16673		2R10R	Nest	96	24.6	27.7	25.1	15.1	5.1	
30-Mar-09	16675		2R10R	Nest	96	24.8	28.5	24.9	13.4	5.0	
30-Mar-09	16676	16677	2R10R	Nest	96	24.5	27.3	24.7	13.3	4.6	anomalous V5
30-Mar-09	16678		2R10R	Nest	96	24.7	28.9	25.3	14.4	5.8	
30-Mar-09	16680		2R10R	Nest	96	24.3	27.7	24.6	14.0	5.1	
30-Mar-09	16681	16682	2R10R	Nest	96	25.6	29.3	25.5	14.9	5.4	
30-Mar-09	16683		2R10R	Nest	96	24.3	28.6	25.4	13.2	5.1	
30-Mar-09	16685		2R10R	Nest	96	24.5	28.2	24.7	14.5	5.3	
30-Mar-09	16686		2R10R	Nest	96	24.8	28.7	25.4	13.7	5.5	
30-Mar-09	16688		2R10R	Nest	89	27.6	30.1	27.8	15.7	7.3	
30-Mar-09	16690	16691	2R10R	Nest	89	27.0	29.6	26.2	15.8	6.4	
30-Mar-09	16692		2R10R	Nest	80	26.9	31.1	27.2	15.8	7.1	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16693		2R10R	Nest	80	26.3	30.7	27.5	15.4	6.8	
30-Mar-09	16694	16695	2R10R	Nest	80	25.6	29.9	28.3	16.5	7.3	
30-Mar-09	16694	16695	2R10R	Nest	146	27.3	29.6	27.7	14.8	6.6	
30-Mar-09	16696		2R10R	Nest	80	26.4	30.2	26.7	17.6	7.1	
30-Mar-09	16698		2R10R	Nest	80	27.4	29.9	27.3	15.6	6.8	
30-Mar-09	16699	16700	2R10R	Nest	80	26.8	29.7	26.3	16.3	6.8	
30-Mar-09	16701		2R10R	Nest	80	26.7	29.9	26.4	15.8	6.5	
30-Mar-09	16703		2R10R	Nest	80	26.7	29.8	27.3	15.8	6.8	
30-Mar-09	16704		2R10R	Nest	80	27.9	31.3	29.3	16.4	7.7	
30-Mar-09	16706		2R10R	Nest	80	26.3	29.7	27.6	15.7	6.4	
30-Mar-09	16707	16708	2R10R	Nest	80	27.6	30.6	28.2	16.5	7.1	
30-Mar-09	16709		2R10R	Nest	80	25.7	28.3	27.2	15.3	6.7	
30-Mar-09	16711		2R10R	Nest	80	26.9	29.5	27.9	16.6	7.0	
30-Mar-09	16712	16713	2R10R	Nest	80	27.4	30.6	28.5	15.5	7.3	
30-Mar-09	16714		2R10R	Nest	80	26.9	30.0	26.7	15.3	6.1	
30-Mar-09	16716		2R10R	Nest	79	28.7	32.9	28.4	16.3	8.3	
30-Mar-09	16717		2R10R	Nest	79	28.3	32.6	28.6	16.4	8.2	
30-Mar-09	16718	16719	2R10R	Nest	79	28.8	31.3	28.5	14.5	7.3	
30-Mar-09	16721		2R10R	Nest	79	27.7	30.9	28.5	15.9	7.6	
30-Mar-09	16722		2R10R	Nest	79	28.8	31.6	28.5	15.9	7.8	
30-Mar-09	16724		2R10R	Nest	79	27.5	30.5	27.7	15.3	7.3	
30-Mar-09	16726		2R10R	Nest	79	27.3	30.1	27.6	16.8	7.7	22 marginals
30-Mar-09	16727		2R10R	Nest	79	26.9	30.8	27.5	16.6	7.5	
30-Mar-09	16729		2R10R	Nest	79	27.9	31.8	28.3	17.4	7.9	
30-Mar-09	16730	16731	2R10R	Nest	79	27.9	31.3	28.0	16.8	7.9	
30-Mar-09	16732		2R10R	Nest	79	28.8	31.8	28.5	17.4	8.1	
30-Mar-09	16734		2R10R	Nest	79	28.6	31.0	27.8	16.8	7.9	
30-Mar-09	16735		2R10R	Nest	79	27.7	31.7	27.6	15.9	7.5	
30-Mar-09	16737		2R10R	Nest	79	28.0	31.9	28.3	16.1	7.3	
30-Mar-09	16738	16739	2R10R	Nest	146	27.5	29.3	26.6	15.2	6.3	anomalous V1
30-Mar-09	16740		2R10R	Nest	146	27.4	30.2	27.5	15.6	6.9	
30-Mar-09	16742		2R10R	Nest	146	26.8	30.1	27.3	15.1	6.2	anomalous V5
30-Mar-09	16743	16744	2R10R	Nest	146	26.9	30.7	28.7	15.3	7.0	
30-Mar-09	16745		2R10R	Nest	146	29.1	31.8	28.3	16.9	8.1	
30-Mar-09	16747		2R10R	Nest	146	28.5	31.8	28.8	16.4	8.0	
30-Mar-09	16748	16749	2R10R	Nest	171	30.1	33.0	30.3	15.9	8.6	
30-Mar-09	16750		2R10R	Nest	171	30.3	32.7	30.0	16.1	8.7	
30-Mar-09	16752		2R10R	Nest	171	28.5	32.1	30.1	16.4	8.8	
30-Mar-09	16753		2R10R	Nest	171	29.2	32.5	29.6	14.8	8.4	
30-Mar-09	16755		2R10R	Nest	171	29.9	33.1	28.9	16.1	8.6	
30-Mar-09	16757		2R10R	Nest	171	28.9	31.6	28.9	15.5	7.7	
30-Mar-09	16758		2R10R	Nest	171	29.9	32.2	29.0	15.9	8.2	
30-Mar-09	16760		2R10R	Nest	171	28.8	31.8	29.2	15.3	8.0	
30-Mar-09	16761	16765	2R10R	Nest	171	30.1	32.6	29.6	16.3	9.1	
30-Mar-09	16763		2R10R	Nest	171	29.3	31.8	29.0	16.5	8.1	
30-Mar-09	16765		2R10R	Nest	171	29.6	32.7	29.6	16.7	8.8	
30-Mar-09	16766		2R10R	Nest	171	29.2	32.8	29.6	16.5	8.7	
30-Mar-09	16767		2R10R	Nest	171	29.4	33.1	29.2	16.3	8.2	
30-Mar-09	16769	16770	2R10R	Nest	166	29.4	32.0	27.3	16.2	7.8	
30-Mar-09	16771		2R10R	Nest	166	29.1	31.6	27.0	15.8	7.6	
30-Mar-09	16773		2R10R	Nest	166	25.5	28.3	25.1	14.0	5.8	
30-Mar-09	16774		2R10R	Nest	166	25.6	28.0	24.3	14.1	5.3	
30-Mar-09	16776		2R10R	Nest	166	30.6	32.7	28.2	15.4	8.3	

Date	ID1	ID2	Notch ID	MOC	Nest #	PL	CL	WD	HT	MASS	COMMENTS
30-Mar-09	16778		2R10R	Nest	166	29.3	31.3	28.2	15.2	7.5	
30-Mar-09	16779	16780	2R10R	Nest	166	28.6	31.1	28.0	14.9	7.2	
30-Mar-09	16781		2R10R	Nest	166	29.4	31.9	27.8	15.7	7.7	
30-Mar-09	16782	16783	2R10R	Nest	166	28.8	31.9	28.2	14.4	7.4	
30-Mar-09	dead		2R10R	Nest	27	29.3	32.3	28.6	16.4	8.0	dead in nest
30-Mar-09	dead		2R10R	Nest	27	27.8	31.0	29.2	16.1	8.0	dead
30-Mar-09	dead		2R10R	Nest	65	27.3	31.8	28.7	16.1	8.2	dead
30-Mar-09	dead		2R10R	Nest	96	26.4	29.9	26.4	12.1	3.4	
30-Mar-09	dead		2R10R	Nest	120	19.7	23.2	20.7	15.5		dead
30-Mar-09	dead		2R10R	Nest	125	30.2	31.6	29.1	15.7	8.3	dead
30-Mar-09	dead		2R10R	Nest	125	27.9	31.0	28.1	14.4	7.6	dead
30-Mar-09	dead		2R10R	Nest	125	28.9	31.4	27.3	15.1	7.7	dead
30-Mar-09	dead		2R10R	Nest	125	29.1	31.2	27.3	13.2	7.3	dead; anomalousV2, V5; V1 kyophotic
						27.66	###	27.62	####	7.42	
						1.344	###	0.566	####	0.212	
						16.2	23.0	15.7	10.9	3.3	
						32.2	35.6	31.2	18.2	10.4	

Date	ID Number	Time	SEX	PL	CL	WD	MASS	RP	HT	HW	DOB	RC	MOC	Location	COMMENTS
19-May-08	474F35741B	12:30	J	47	57	46	25	8	26	13.2	2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	474D3F745C	12:30	J	45	55	45	22	8	25		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	474C601F36	12:30	J	49	59	47	30	9	26		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	474E721316	12:30	J	48	61	48	32	9	26		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	4752402E78	12:30	J	53	65	52	40	9	26		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	4753324E1B	12:30	J	45	55	45	26	8	24		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	474F59344F	12:30	J	48	60	48	31	8	26		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	474C4F5421	12:30	J	48	61	48	35	8	27		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	4518635B06	12:30	J	44	52	44	22	8	24		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
19-May-08	451E5D0618	12:30	J	47	58	46	27	8	25		2007		Nest		Head start Turtles hatched 10/7/07 nest 148
3-Jun-08	451E600F49 (PI 0053)	12:00	F	195	220	164	1656	29					Hand		Recapture, lost both pit tag and metal tag
5-Jun-08	451644390B	9:00	F	196	215	170	1741	28	93				Hand		
5-Jun-08	451F466A12	14:00	J	72	86	68	87	8	36		2005				3 year old needs rehab
10-Jun-08	4519271437	7:45	F	196	216	165	1980	24	100				Hand		
13-Jun-08	4516365647 (PI 0056)		F	195	222	169	1682	24	92	38.7		Y	Hand		
17-Jun-08	451E600002 (PI0057)		F	204	232	174	1944	30	97			Y	Hand		
18-Jun-08	4753383164 (PI 0034)		F	189	205	177	1501	26	100				Hand	N 38 45.091 W76 22.313	Laid nest 2008-67 clutch size 14
18-Jun-08	4750045537 (PI 0033)		F	187	209	160	1439	29	92			N	Hand	N 38 45.075 W76 22.450	
18-Jun-08	4519145B0D		J	64	72	58	77	9	32		2007		Hand		probably 1 year old found in notch
19-Jun-08	451E7B080(C or 8) (PI 0058)		F	200	217	175	2088	29	102			N	Hand		
19-Jun-08	4519196D11 (PI 0059)		F	183	212	170	1639	27	90			Y	Hand	N 38 45.093 W76 22.478	Nest # 2008-72
20-Jun-08	451F5F127F (PI 0060)		F	196	216	169	1673	94	28	42.1		N	Hand	N 38 45.641 W76 22.799	Nest # 2008-73

Date	ID Number	Time	SEX	PL	CL	WD	MASS	RP	HT	HW	DOB	RC	MOC	Location	COMMENTS
20-Jun-08	451E7D0B70 (PI 0061)		F	185	213	169	1489	24	90	38.4		N	Hand		
20-Jun-08	45191D1B37 (PI0062)		F	194	240	166	1707	31	99	41.2		Y	Hand		
20-Jun-08	4518753A52 (PI 0063)		F	201	225	171	1762	26	100	42.1		Y	Hand	N 38 45.077 W76 22.454	Laid nest 2008-77
24-Jun-08	4519104B7F		J	76	88	71	107	13	37				Hand	N 38 45.168 W76 22.439	
24-Jun-08	451E447B4C		J	69	80	65	87	11	34				Hand	N 38 45.169 W76 22.440	
24-Jun-08	451F785563		J	69	78	64	79	10	35				Hand	N 38 45.169 W76 22.440	Recaptured in notch 7/9/2008
24-Jun-08	Dead		J	37	43	37	8	6	17	11.1			Hand	N 38 45.681 W76 22.810	Dead when found
1-Jul-08	45176F274A (PI 0064)		F	194	213	160	1632	22	160	38.1		N	Hand	N 38 45.073 W76 22.452	
1-Jul-08	451E4C0B1F		J	81	95	76	142	13	76	19.7			Hand	N 38 45.101 W76 22.355	
1-Jul-08	474D571978 (PI 0036)		F	196	224	173	1844	26	96			N	Hand	N 38 45.092 W76 22.318	
2-Jul-08	45191C2E67 (PI 0065)		F	200	220	165	1612	32	97	41		Y	Hand	N 38 45.032 W76 22.167	Laid nest 2008-119
3-Jul-08	451E75300B (PI 0066)		F	205	225	174	1909	27	94			N	Hand	N 38 45.662 W76 22.803	
9-Jul-08	451F466A12		F	71	86	68	95	8	37	7					Rehab turtle
10-Jul-08	451E501C5B (PI0067)		F	191	216	168	1380	28	92	38.5		Y	Hand	N 38 44.963 W76 21.995	
10-Jul-08	451F6E2754 (PI 0068)		F	190	204	159	1424	29	92			N	Hand	Cell 2	
10-Jul-08	451E4F7039		F	196	227	178	1877	32	95			N	Hand	Cell 1a	
15-Jul-08	451801727B (PI 0070)		F	202	220	169	1604	27	89	35.8		N	Hand	N 38 44.721 W76 22.501	Found diging nest but was not gravid, came out of cell 5
15-Jul-08	451E782C66 (PI0071)		F	207	222	169	1926	30	94	35.9		N	Hand	N 38 45.360 W76 22.943	
16-Jul-08	4517760F20 (PI 0027)		F	198	222	178	1738	25	96	36.9		N	Hand	N 38 45.113 W76 22.480	Most likely laid nest 2008-165
21-Jul-08	4517694933 (PI 0072)		F	203	224	164	1920	23	97	41.5		Y	Hand	N 38 45.082 W76 22.297	turtle was nesting in notch, scared off by tour bus
24-Jul-08	4517694933		J	44	49	41	13	7	23		2007	N	Hand	N 38 45.080 W76 22.458	

Date	ID Number	Time	SEX	PL	CL	WD	MASS	RP	HT	HW	DOB	RC	MOC	Location	COMMENTS
25-Jul-08	4519190971		J	74	86	71	79	11	34		2006	N	Hand	N 38 45.208 W76 22.427	
25-Jul-08	45163E4F0B (PI 0073)		F	196	218	178	1943	28	96				Hand	N 38 45.500 W76 22.655	
28-Jul-08	451F001E06	12:00	J	75	83	67	89	12	33	18.0	2005		Hand	N 38 45.141 W76 22.472	
30-Jul-08	451924272E	13:00	F	83	92	77	148	13	39	20.5	2003		Hand	N 38 45.149 W76 22.466	
14-Aug-08	451E604004	11:00	M	120	139	110	420	18	57	24.0	2003		Hand	1a	
28-Aug-08	4966432573 (10R12R9L)	9:00	M	79	90	78	38	##	12	1.0					Arlington turtle
28-Aug-08	494C71081D (7R11R9L)		F	78	95	73	139	11	39	1.0					Arlingotn turtle
11-Sep-08	4159190971		F	76	86	70	97	10	37	3.0			Hand	N 38 45.160 W76 22.462	
15-Sep-08	4A745D417B (10R12R9L)		M	81	95	79	168	11	41	3.0			Hand	1a	13r and 13l marg
25-Sep-08	45180C5419 (2R12R9L)		F	104	116	102	278	18	51						Head start
25-Sep-08	45177E011F (9R12R9L)		F	95	110	93	304	15	93						Unable to recognize 12R9L

Date	Notch ID	PIT ID	Sex	PL	CL	Width	Height	Weight	RP	DOB	Comments
27-Apr-09	2R12R	4B182F6D45	2	118.7	134.3	113	54.8	427	21.8	2008	NAIB
27-Apr-09	2R11L	4B021D407E	3	59.6	70.5	59.5	29.6	61	9.2	2008	NAIB
27-Apr-09	2R12R	4B1E765101	2	72.7	81.5	69.4	36.7	103	11.8	2008	NAIB
27-Apr-09	2R12R	4B18520C49	2	88.5	103.4	84.3	46.1	191	15.2	2008	NAIB
27-Apr-09	2R10L	4A706D241F	2	65.3	77.6	64.2	34.5	82	10.6	2008	NAIB
27-Apr-09	2R10L	4B017E7853	2	110.9	126.6	104.3	51.3	367	17.4	2008	NAIB; Ano V5
27-Apr-09	2R12R	4B017F4652	3	89.9	100.7	83.3	43.9	184	13.6	2008	NAIB
27-Apr-09	2R9L12L	4A70753878	3	94.1	109.1	88.1	47.9	240	14.6	2008	NAIB
27-Apr-09	2R9L12L	4B021F7E0C	2	101.1	113.4	91.3	47.3	251	16.7	2008	NAIB
27-Apr-09	2R10L	4B18065013	2	80.1	97.8	80	43.7	177	12.5	2008	NAIB
27-Apr-09	2R10L	4B017E6C37	2	100.8	108.4	98.2	47.4	264	19.2	2008	NAIB
27-Apr-09	2R12L	4B1E3A785D	2	90.3	101.9	80.7	43.5	181	12.2	2008	NAIB
27-Apr-09	2R11L	4B1E7C6762	2	68.1	83.7	64.1	34.1	91	10.1	2008	NAIB
27-Apr-09	2R12L	4A706A783B	2	98	112.6	90.4	50.6	255	15.8	2008	NAIB
27-Apr-09	2R10L	4B020D0B3A	2	74.8	86.1	73.1	37.5	119	12.1	2008	NAIB
27-Apr-09	2R11L	4B1E765864	2	104	124.1	101.4	51.1	344	17	2008	NAIB
27-Apr-09	2R12R	4A70732176	3	44.8	53.1	42.4	22.2	27	7.9	2008	NAIB
27-Apr-09	2R11L	4A705F6254	1	94.5	113.1	91.1	43.2	267	14.5	2008	NAIB
27-Apr-09	2R9L12L	4B184A6C08	2	88.7	102.7	83.7	43.9	186	14.6	2008	NAIB
27-Apr-09	2R9L12L	4B185F7753	2	53.5	67.9	50.7	29.7	58	8.2	2008	NAIB
27-Apr-09	2R11L	4B1F073111	2	62.2	75	59.9	32.4	76	9.7	2008	NAIB
27-Apr-09	2R9L12L	4B022B071A	2	87.4	104.9	81.4	42.8	168	12.6	2008	NAIB
27-Apr-09	2R11L	4A706D6919	2	61.6	72.6	59.4	31.6	66	8.4	2008	NAIB
27-Apr-09	2R9L12L	4B18051019	2	87	106.9	82.7	43.8	196	13	2008	NAIB
27-Apr-09	2R9L12L	4B0227004C	2	109.7	122.5	99.9	51.6	314	17	2008	NAIB; Ano V5; 5 costals on left
27-Apr-09	2R9L12L	4A70700E4D	2	73	83.5	68.4	36.7	103	12.4	2008	NAIB
27-Apr-09	2R12R	4A7079197D	3	40.8	47.9	41.3	21.7	24	6.3	2008	NAIB
27-Apr-09	2R8L9L	4A725E283C	2	75.4	86.9	69.8	36.5	112	12.4	2008	5 costals on both sides; Carroll Co.
27-Apr-09	2R8L	4A753C5A52	2	71.3	83.4	68.9	36.5	108	12.1	2008	Carroll Co.
27-Apr-09	2R2L9L	4A74607974	2	63.3	73.9	53.4	35.1	75	10.2	2008	Carroll Co.
27-Apr-09	2R12L	4A75154533	2	62	75.6	58.1	33.6	76	10.3	2008	Carroll Co.
27-Apr-09	2R9L11L	4A75341E66	2	64.3	76.8	61.5	33.1	79	10	2008	Carroll Co.
27-Apr-09	2R12L	4B177A0133	2	64.7	79.5	61.8	33.1	82	10.1	2008	Carroll Co.
27-Apr-09	2R12L	4A722A6221	3	74.9	89.4	69.9	37.8	118	11.1	2008	Kent School
27-Apr-09	1R2R10R9L	4A753B1608	2	71.1	83.3	66.3	35	104	10.8	2008	Ano. Nuchal; Kent School
28-Apr-09	2R9R10R9L	494F29614B	2	68.8	82.1	67.2	34.2	98	10.3	2008	5 Costals on left; Solley
28-Apr-09	2R9L11L	4B17533423	1	64.9	77.7	64	33.2	81	9.7	2008	Solley
28-Apr-09	2R9L	4B16115E49	2	71.1	85.2	67.8	33.6	100	10.4	2008	Suthpin Edgewater
28-Apr-09	2R2L9L	4B17681A17	3							2008	Old Mill High
28-Apr-09	2R2L9L	4B13336F5F	2	73.4	83.1	66.3	35.4	94	11.4	2008	Old Mill High
28-Apr-09	2R9L	4B1756460B	2	98.3	112	91.9	44.5	247	14.5	2008	West Annapolis
28-Apr-09	2R10R	4B13305634	2	96.9	116.1	92.8	43.5	251	16.4	2008	West Annapolis
28-Apr-09	2R10L	4A746E1932	2	96.4	111.7	93.8	48.4	252	15.8	2008	Schmidt
28-Apr-09	2R12L	494D0C0C36	2	84.4	95.7	82.3	39.9	173	14.2	2008	Ben Field Fisher
28-Apr-09	2R9L	4B17530E2C	2	70.3	84.1	67.1	36	100	11.4	2008	Suthpin Edgewater
28-Apr-09	2R9L	4A76260A1A	2	94.4	107.4	84.5	46.9	201	13.7	2008	Chesapeake HS Mattin
28-Apr-09	2R1L9L	494E410263	2	69.7	82.5	64.3	35.6	100	12.6	2008	Severn River MS Hudson
28-Apr-09	2R10R	4A72086B34	2	94.6	112	91.3	46.8	241	15.1	2008	Shipley Choice Smith Pearl

Date	Notch ID	PIT ID	Sex	PL	CL	Width	Height	Weight	RP	DOB	Comments
28-Apr-09	2R12R9L	4A753A461B	2	57.2	67.2	57.1	31.6	65	7	2008	Tracey's Ormond #1
28-Apr-09	2R9R9L	4B16141F0B	2	57.7	74.6	63.2	29.3	63	10.8	2008	Tracey's Ormond #2
28-Apr-09	2R12R9L	4B17580E08	2	101.9	121.5	101.4	56	329	13.4	2008	Shipley Choice Smith Seaweed
28-Apr-09	2R9R9L	4A71136329	2	67.3	77.6	63.9	33.7	81	8.4	2008	Harman Bubbles
28-Apr-09	2R8R9L	4B162B2041	2	66.4	79.1	63.6	33.3	87	11.1	2008	Hannah Moore Dickson
28-Apr-09	2R10R9L	4A76357E1B	3	73.5	82	67.9	37.3	103	9.7	2008	Chesapeake HS #1
28-Apr-09	2R9L11L	4B1779497F	1	72.3	88.4	73.5	39.7	122	11.2	2008	Chesapeake HS #2
28-Apr-09	2R9R	494107730B	2	70.9	83.1	66.9	34.7	98	9.7	2008	Severna Park HS #1
28-Apr-09	2R11R9L	4B164BO9OD	2	68.8	79.4	63.1	32.8	79	9.8	2008	Severna Park HS #2
28-Apr-09	2R1L9L	494C6E33824	2	89	101.7	82.4	41	171	15.8	2008	Chesapeake HS Tippy
28-Apr-09	2R3L9L	494D0C6010	2	93.6	90.5	72.3	38.8	130	9.9	2008	Folger McKenzie
28-Apr-09	1R2R9L	4A76291424	2	75.7	89	71.1	38	116	11.2	2008	Riveria Beach #1
28-Apr-09	2R8L9L	494B570646	2	75.3	86.7	73.6	36.9	118	10.1	2008	Riveria Beach #2
28-Apr-09	2R2L9L	4960264910	2	101.3	112.5	91.7	49	242	16	2008	SCES
28-Apr-09	2R9R9L	4A745F566F	1	72.5	83.8	63.3	33.9	99	10.7	2008	Meade Heights
28-Apr-09	2R12R9L	4B1665335A	2	55.9	65.5	54.2	29.8	59	7.8	2008	Meade Heights
28-Apr-09	2R11R	4B17702946	3	76.4	87.3	69.6	37	118	10.3	2008	5 Costals on left; Edgewater Pebbles
28-Apr-09	2R9L	4B16353F0B	2	64.7	77.6	59.7	32.1	77	10.7	2008	Extra costal on both sides: no nuchal; Lindale Greenlee
28-Apr-09	2R11R9L	4B182E2174	2	70	80.4	64.2	36.4	91	11	2008	Lindale Greenlee
28-Apr-09	2R10R9L	4B133D1515	2	55.3	64.5	51.2	29.3	52	8.4	2008	George Fox MS Thompson
28-Apr-09	2R12L	4B18200C34	2	51.3	60.9	47.8	26	41	8.7	2008	George Fox MS Thompson
28-Apr-09	2R2L9L	4B17712952	2	70.8	81.8	63.5	34.4	89	10.3	2008	Meade Heights Burgess
28-Apr-09	2R9L	4B18236827	2	70.6	83.8	67.2	36.8	96	10.4	2008	Meade Heights Burgess
28-Apr-09		4B175B7223	3	73.2	83.9	68.3	35.9	104	9.5	2008	Deale ES Bosworth Pokey
28-Apr-09	2R3L9L	4B1819102E	2	63.8	76.8	61.3	33.1	80	10.9	2008	Deale ES Bosworth Deale
28-Apr-09	2L	4B1769212F	2	80.2	94.9	76.2	39.8	137	10.8	2008	CBMS Maciolek Splash
28-Apr-09	2R11R9L	4B13481339	3	63.8	95.4	75.5	38.8	146	12.5	2008	CBMS Maciolek Crash
28-Apr-09	2R6R9L	4B1613766B	2	90.2	104.3	85.4	43.6	197	12.2	2008	Southern
28-Apr-09	2R3L9L	4B17715324	2	82.2	99.3	77.7	41.1	160	11.8	2008	Southern
28-Apr-09	2R3L9L	4B176366166	2	95	112.1	89.6	46.5	234	15.1	2008	13 marginals on right; Ano. V4, V5; Lindale Greenlee
28-Apr-09	2R9L	4B175E6F3A	2	84.9	100.5	81.8	42.3	169	11.7	2008	Lindale Greenlee
28-Apr-09	2R3L9L	4B16445117	2	87.9	102.3	81.2	44.8	188	14.4	2008	CBMS Were Lightning
28-Apr-09	2R8R9L	4B17736607	2	94	110	89.4	48.6	230	12.7	2008	CBMS Were Bubbles
28-Apr-09	2R9L10L	4B16256C77	2	57	65.4	55.4	31	59	6.2	2008	Ano. V1, V2, V3; Edgewater Jessie
28-Apr-09	2R1L9L	4B17583978	2	65.7	76.4	60.6	31.7	80	9.9	2008	Edgewater Jessie
28-Apr-09	2R11R	4B1756205F	3	80.9	80.2	66.8	37	97	10.9	2008	Nantucket Rowland
28-Apr-09	2R8L9L	4B16143B12	2	75.8	85.7	70.9	37.3	122	12.2	2008	Ano. V5; Nantucket Rowland
28-Apr-09	2R9R	4B16356F0C	2	60.3	70.4	57.4	31.4	67	10.7	2008	Edgewater Dennin

Date	Notch ID	PIT ID	Sex	PL	CL	Width	Height	Weight	RP	DOB	Comments
28-Apr-09	2R11R9L	4B176F1F51	2	60.3	70.6	56.8	30.9	63	8.3	2008	Ano. V1, V5; Edgewater Dennin
28-Apr-09	2R2L9L	4B160D5830	2	76.4	91	72.4	37.3	126	12.7	2008	AE Patrick
28-Apr-09	2R8R9L	4B18113D05	2	79.8	95.2	79.2	38.4	151	12.6	2008	Ano. V5; AE Stacey
28-Apr-09	1R2R9L	4B18114838	2	77.3	88.8	71.7	37.8	119	12.8	2008	Ano. V4; 5 costals on both sides; Chesapeake Sci Paarlberg
28-Apr-09	1R2R10R9L	4B180A780D	2	72.1	85.2	66.8	36.7	103	8.7	2008	Chesapeake Sci Paarlberg
28-Apr-09	2R10R	4B175C006C	2	83.8	97.1	70.4	41.5	166	12.9	2008	AE Steve
28-Apr-09	2R10R9L	4B175F6251	2	78.4	89.6	73.2	38.7	131	12.3	2008	AE Barry
28-Apr-09	2R8L	4B17716577	2	60.4	78.8	64.2	36.3	95	10.9	2008	Brooklyn Park Prestige
28-Apr-09	2R12L	4B182E4720	2	75.4	90.1	70.5	39.2	123	12.2	2008	Duffy Bodkin #2
28-Apr-09	2R2L9L	4B16125B03	2	79.3	90.3	71.4	38.3	119	11.2	2008	Edgewater Glider
28-Apr-09	2R12R9L	4B180E0277	3	77.9	91.6	75.7	39	137	10.8	2008	Duffy Bodkin #1
28-Apr-09	1R2R9L	4B161B763C	2	68.7	80.6	65	35.6	93	10.7	2008	Hudson Severn River
28-Apr-09	2R9L10L	4B176A4E6D	3	79.8	88.9	75.6	38	131	11.8	2008	Broken PIT Tag still reads; AE Dining Hall
28-Apr-09	2R10R9L	4B17532D38	2	78.9	91.9	78.2	38.8	136	10.8	2008	Benfield Elem. Skeeter
28-Apr-09	2R8L	4B176A1418	2	74.8	87.6	73.6	39.1	127	10.4	2008	AE Dining #2
28-Apr-09	2R9L	4B176A5461	1	67.6	82.8	64.6	34.3	92	9.9	2008	26 marginals: Bodkin #1 Rush
28-Apr-09	2R8L10L	4B17620E43	2	72.7	84.5	69.5	35.5	115	12.1	2008	Bodkin #2 Rush
28-Apr-09	2R8L	4B16296836	2	88	104.5	87.1	44.2	211	14.1	2008	Ano. V5; Arnold Squirtle
28-Apr-09	2R9R	4B16140D41	2	89.3	107.6	86.2	42.7	209	12.4	2008	Ano. V5; 5 costals on each side; Arnold Spongebob
28-Apr-09	2R12R9L	4B17792254	3	78.9	91.2	78.2	38.2	133	10.8	2008	Bodkin Zoller Bubbles
28-Apr-09	2R10R	4B16482645	2	80.7	93.8	79.1	37.3	143	12.7	2008	Bodkin Zoller Splash
28-Apr-09	2R8L9L	4B18201973	2	80.6	93.3	74.7	37.9	133	12.9	2008	26 marginals; Eason/ Lynch
28-Apr-09	2R11R10L	4B1805685B	1	84.3	98.3	77.6	37.8	147	14	2008	26 marginals; Ano V5, V6; Eason/ Lynch
28-Apr-09	2R3R9L	4B1756017F	1	77.6	91.7	72.9	36.9	132	12.4	2008	SPES Commander Cody
29-Apr-09	2R11R	4B17761873	2	57.4	69	55.1	29.5	60	8.2	2008	5 costals on right; Rolling Knolls
29-Apr-09	2R8L9L	4B17671574	2	66.1	74.7	61.3	32.5	76	10.7	2008	Rolling Knolls
29-Apr-09	2R8L	4B16357D46	1	76.4	89	72.6	36.9	112	14.8	2008	SPES Flapjack
29-Apr-09	2R9L11L	4B17582F28	2	68.9	84.5	67.1	36.7	112	10.5	2008	SPES Woelpper
29-Apr-09	2R8L	4B1354322E	2	64.1	74.1	64	33.8	92	15	2008	Ano. V5; missing right pectoral scute; SPES Woelpper
29-Apr-09	2R10R9L	4B17662E4C	3	81.2	93.7	74.7	38.7	136	12.4	2008	SPES Joy
29-Apr-09	2R10R9L	4B16104F00	2	84	99.1	76.8	39.5	147	14.4	2008	SPES Happy
29-Apr-09	2R9L11L	4B13361B59	2	75	89.7	70.8	36	109	11.8	2008	Helms/ Geier
29-Apr-09	2R1L9L	4B16165818	2	73.9	86.4	66.6	36	112	11	2008	Split tail; Helms/ Geier
29-Apr-09	2R8L9L	4B17667946	2	78.4	87.3	74.8	37	131	12	2008	Folger McKinsey
29-Apr-09	2R8R9L	4B176A2546	2	89.7	106	87	43.9	206	14.3	2008	Oakhill Lawton
29-Apr-09	2R9R	4B16223053	2	57.7	67.5	55.3	29.6	59	9.5	2008	Piney Orchard
29-Apr-09	2R9R	4B1827406E	2	72.1	84.6	67.3	34.3	110	12.6	2008	Oakhill Lawton
29-Apr-09	2R1R9L	4B1771327D	2	63	72.1	59.9	30.7	67	10.8	2008	Piney Orchard

Date	Notch ID	PIT ID	Sex	PL	CL	Width	Height	Weight	RP	DOB	Comments
29-Apr-09	2R9R	4B1759331E	2	65.1	76.7	62.8	33.9	84	11.1	2008	Ridgeway
29-Apr-09	2R10L	4B16261268	2	84.6	98.3	83.3	40.4	166	12.2	2008	Annapolis Middle
29-Apr-09	2R8L9L	4B1627135F	3	68.5	77.2	62.4	33	87	10	2008	Ridgeway
29-Apr-09	2R11R	4B18191F65	2	60.2	69.6	57.2	31.4	67	9.4	2008	Ano. V5, V6; Harmon Roser
29-Apr-09	2R8L9L	4B1778765D	2	60.5	67.3	55.4	30.6	63	9.1	2008	Harmon Roser
29-Apr-09	2R11R9L	4B17786C51	2	73.4	84.1	66.7	35.6	95	12.1	2008	Harmon Dembeck
29-Apr-09	2R9L	4B17641424	2	73.4	83.6	70.5	34.7	115	10.5	2008	Harmon Dembeck
29-Apr-09	2R3L9L	4B1778265A	2	65.5	79.5	61.4	33.6	93	11.8	2008	Marley Middle Shores
29-Apr-09	2R9R9L	4B16212B0F	2	109.8	129.1	105.3	54.2	360	16.7	2008	Shipley's Choice
29-Apr-09	2R8L9L	4B17637736	2	66.5	76.7	62.7	33.3	83	12.2	2008	Ano. V5; Marley Middle Shores
29-Apr-09	2R10R9L	4B18115D7F	3	58.9	69.3	55.9	29.7	59	8.8	2008	Harmon Jones
29-Apr-09	2R12L	4B13326123	2	72.5	83.3	67.2	37.1	108	13.5	2008	Harmon Jones
29-Apr-09	2R11R	4B160C6546	2	71.2	81.3	67.9	35	101	8.6	2008	Harmon Jones
29-Apr-09	2R9R9L	4B16177570	2	54.7	65.1	52	28	46	9.2	2008	Green School
29-Apr-09	2R3L9L	4B177C1B54	2	74.2	89.1	72.4	38.3	133	10.2	2008	Davidsonville
29-Apr-09	2R10R9L	4B17530F0F	2	54.1	63.9	48.8	26.8	46	9	2008	Green School
29-Apr-09	2R2L9L	4B17547F74	2	55.9	66.6	53.8	28.3	57	8.4	2008	Odenton
29-Apr-09	2R8R9L	4B175A0962	2	55.9	66	53.9	27.7	52	8.9	2008	Odenton
29-Apr-09	2R8R9L	4B1760035B	2	83.8	97.5	77.6	39.6	159	13	2008	Davidsonville
29-Apr-09	2R8L9L	4B16204509	2	59.4	65	53.6	29.2	57	10.5	2008	Overlook McGowan
29-Apr-09	2R11R	4B180A5571	2	58.6	64.7	50.5	27.2	52	9.3	2008	5 costals on left; Overlook McGowan
29-Apr-09	2R11R8L	4B1771380F	2	94.9	106.3	85.5	41.7	212	13.9	2008	Ano. V5; Davidsonvillle Perret
29-Apr-09	2R9R	4B161A1919	2	93.2	107	86.5	42.3	218	15.1	2008	Davidsonville Perret
29-Apr-09	2R8L9L	4B1610616B	3	64.4	75.1	62.2	31.3	71	10.2	2008	Overlook
29-Apr-09	2R9R	4B16240166	2	63	75.4	59.3	30.1	73	10.3	2008	Overlook
29-Apr-09	2R3L9L	4B17637502	2	74.8	88.3	68.7	35.7	108	11.3	2008	Hillsmere
29-Apr-09	2R9L11L	4B162A5B2F	2	78.9	92.6	78.7	38.9	155	12.7	2008	South Shore
29-Apr-09	2R9R9L	4B17672E58	2	84.3	99.8	81	41.2	179	12.6	2008	South Shore
29-Apr-09	2R9R9L	4B176A007C	3	80	95	75	38.1	130	12	2008	Hillsmere
29-Apr-09	2R9L11L	4B177D171C	2	90.6	105.7	86.6	44.6	199	15.5	2008	Wheeler
29-Apr-09	2R10R	4B177F784A	2	82.7	97.2	79.4	41	158	12.5	2008	Wheeler
30-Apr-09	2R12L	4B134C5562	2	91.8	107.9	85.2	43.4	195	15.2	2008	Van Bokkelan
30-Apr-09	2R10R9L	4B176E2150	2	66.7	77.4	63	32.8	85	10.7	2008	Nones
30-Apr-09	2R12L	4B13374B4A	2	67.1	77.6	61.5	33.7	83	11.5	2008	Nones
30-Apr-09	2R1L9L	4B16084915	2	70.4	79.6	65.6	34.7	95	11.8	2008	Hilltop Spike
30-Apr-09	2R9R9L	4B134A416B	1	95.8	110.7	86.9	46.2	226	15	2008	Van Bokkelan
30-Apr-09	2R9R	4B177B0A76	2	69	80.8	62.2	34.5	86	10.4	2008	Hilltop Payne
30-Apr-09	2R1L9L	4B18201135	2	73.1	83.5	68.8	35.4	106	11.6	2008	North County
30-Apr-09	2R10R9L	4B1625621F	2	81.9	92.8	76.4	37.5	140	12.5	2008	North County
30-Apr-09	2R8L9L	4B18097A4A	2	80.8	92.3	76	37.9	144	12.3	2008	Pasadena
30-Apr-09	2R11R9L	4B13492273	2	78.5	89.4	72.1	37.5	121	12.6	2008	Pasadena
30-Apr-09	2R8L9L	4B177B5120	2	97.4	109	90.8	42.7	207	14.8	2008	Fairland
30-Apr-09	2R8L9L	4B1334040B	2	58.9	67.9	54.7	28.4	54	8.6	2008	Ano. V5; 13 marginals on right; Cape St Clare
30-Apr-09	2R8L	4B17535805	2	58.8	67	54.7	30.3	55	9.8	2008	Cape St Clare
30-Apr-09	2R8L9L	4B177A063E	2	65.5	77.1	61.9	31.3	77	9.5	2008	Ano. V5; 26 marginals; Brooklyn Park
30-Apr-09	2R1L9L	4B16564F0A	2	67.3	77.2	63.8	33.5	81	10.1	2008	Fairland
30-Apr-09	2R9R	4B13337D15	2	87.6	102	83.2	42.7	180	13.5	2008	St Mary's Annapolis
30-Apr-09	2R8L9L	4B1648152F	3	73.4	87	68.9	34.8	108	11.4	2008	Annarundel HS

Date	Notch ID	PIT ID	Sex	PL	CL	Width	Height	Weight	RP	DOB	Comments
30-Apr-09	2R9R11L	4B17542A4A	2	78.8	90.5	73.5	39	126	11.9	2008	St Mary's Annapolis
30-Apr-09	2R8L9L	4B16141040	2	72.3	82.5	67.6	35.3	92	11.2	2008	CAT North
30-Apr-09	2R3L9L	4B18236904	2	71.4	84.5	67.5	35.8	100	10.8	2008	CAT North
30-Apr-09	2R9L11L	4B1624774C	2	81.9	97.5	82.6	42.6	164	13.5	2008	Ann Arundel HS

Diamondback Terrapin, *Malaclemys terrapin*, Nesting and Overwintering Ecology

A thesis presented to

the faculty of

the College of Arts and Sciences of Ohio University

In partial fulfillment

of the requirements for the degree

Master of Science

Leah J. Graham

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Diamondback Terrapin, *Malaclemys terrapin*, Nesting and Overwintering Ecology

by

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has been approved for

the Program of Environmental Studies

and the College of Arts and Sciences by

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ABSTRACT

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Poplar Island Environmental Restoration Project is a unique solution for the dredge material placement and restoring decreasing habitat in the Chesapeake Bay. Since 2002, a long-term terrapin monitoring program has been documenting diamondback terrapin, *Malaclemys terrapin* habitat use. Northern diamondback terrapins, hatchlings may either emerge from their nest in the fall and seek other overwintering hibernacula, or remain inside their natal nest to emerge the following spring, known as delayed emergence. Results from the 2007-08 nesting season found that compaction and the presence of ice nucleating agents (as a measure of crystallization temperature) affected nest emergence timing in hatchlings. Fall emerged nests had lower bulk density (less compacted) and had a higher potency of ice nucleating agents compared to spring emerging nests. With proper management, areas such as Poplar Island may become areas of concentration for terrapins and thus provide a source population for the terrapin recovery throughout the Bay.

Approved: ____

Willem M. Roosenburg

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CHAPTER 1: TERRAPIN NESTING ECOLOGY

Increases in human populations result in; habitat destruction, habitat infrastructure deterioration, introduced species, subsidized predators, and overexploitation of natural resources for food and pets (Klemens, 2000). Estuarine ecosystems continue to be threatened as human population growth increases in coastal areas and development increases habitat loss, shoreline erosion, and subsidence (Mitro, 2003). These combined with global climate change's effect on sea levels results in loss of shoreline habitat and suitable terrapin nesting habitat in the Chesapeake bay (CENAB, 2009a). The United States' coastal ecosystems act as a storm buffers for communities, purify waters, and sustain coastal economies with billions of dollars in fisheries, tourism, transportation, and recreational income (Costra-Pierce and Weinstein, 2002). However, as states experience increase in population growth and development, habitat loss and the degradation of water quality threaten coastal economies (Costra-Pierce and Weinstein, 2002). As encroachment continues, local, state, and the federal government are turning to restoration to recreate habitat (Klemens, 2000). The Clean Water Action Plan and the Coastal Wetlands Protection, Planning, and Restoration Act are working to increase the area of restored wetland in the US (Costra-Pierce and Weinstein, 2002). Disposal of uncontaminated dredge materials into the Nation's waters and landfills creates an unnecessary waste of America's ecological, economic, engineering and scientific wealth (Costra-Pierce and Weinstein, 2002). Coastal wetland and beach ecosystem restoration has been identified as a national priority by the National Research Council and potentially offers the opportunity to use uncontaminated dredge material in a constructive manner. (Costra-Pierce and Weinstein, 2002).

The Chesapeake Bay is the largest estuary in North America, covering 500 hectares of water (USACE, 2006) with a 16,575,900 hectare watershed. The Chesapeake Bay has over 3,600 species of flora and fauna in this complex ecosystem with a human population that exceeds 18 million people (CBP, 2009). The bay was created over 10,000 years ago with the retreat of the last glaciations in the Susquhanna River Valley. The Algonquins, Native Americans, residing in the bay watershed, called the bay Chesepiook, meaning “great shellfish bay”. Today the bay provides millions of dollars in commercial and recreational value from its recreational and commercial fishery industry. The commercial and recreational species include blue crab, oyster, striped bass, and waterfowl. The bay also provides economic and educational resources in a multiuser environment (USACE, 2006). The protection and restoration of the bay’s resources is considered vital to its future (USACE, 2006).

The port of Baltimore also is vital to the region’s commerce. The Baltimore Port is one of the busiest ports on the East Coast (USACE, 2006; CENAB, 2009b). Its inland location and access to highways give it the ability to access manufacturing centers in the Midwest and one third of all U.S. households in a day’s drive (USACE, 2006). The Baltimore Port Authority handles over 40 million tons of cargo annually, and foreign commerce valued at $26 billion (USACE, 2006). The Baltimore Port contributes $1.9 billion in business to Maryland’s economy and generates over 50,000 jobs (CENAB, 2009b). In order to keep the port navigable, dredging of the waterways and canals leading to the port is necessary. In the next twenty years, however, there will be critical shortage of placement capacity and sites for dredged material from the Baltimore Harbor and its approach channels (USACE, 2006).

Under the USACE Engineering Regulation (ER) 1105-2-100, the USACE Districts must develop Dredged Material Management Plans for all federally maintained harbors and waterways. The plans must address the placement of dredge material with minimal environmental impact and identify projects that provide sufficient placement capacity to accommodate maintenance dredging (USACE, 2006). One USACE solution for dredged material from Chesapeake & Delaware Approach Canals and Chesapeake Bay Approach Canals (MD) was to create environmental restoration islands (Figure 1). Poplar Island Environmental Restoration Project (PIERP) is a unique man made island that restores upland and wetland habitat that is being lost throughout the bay area. I explore how diamondback terrapins, *Malaclemys terrapin*, use nesting beach habitat that has been created by PIERP. Most research on wildlife habitat use on dredge material islands has been focused on the avifauna or benthic populations and communities. Poplar Island Environmental Restoration Project has monitored terrapin nesting activity since 2002 and herein I document the terrapin nesting there to identify how large-scale restoration projects affect terrapin populations.

Materials and Methods

Study Site: Poplar Island Environmental Restoration Project

Poplar Island is an environmental restoration project in the middle Chesapeake Bay at 38°46’ N and 76°23’ W, approximately 34 nautical miles southeast of Baltimore and 1 mile northwest of Tilghman Island, MD (USACE, 2006 CENAB, 2009a). The U.S. Army Corps of Engineers, Maryland Port Administration, and Maryland Environmental Services are reconstructing Poplar Island using dredged material from the Chesapeake and Delaware Canal approach channels and the Chesapeake Bay approach channels. The island is being restored to its original size of 400 hectares in the 1800s after having been eroded to less than 4 hectares by 1998 (CENAB, 2009a). Stone perimeter dikes prevent erosion of the island and protect exposed shores; interior and sheltered dikes are constructed of sand. The PIERP goal is to provide long term stable storage dredge material while simultaneously creating upland and wetland habitats that existed in the Poplar Island Archipelago 150 years ago. The wetland cells will constitute more than 297 hectacres of the island's area with restoration hydrodynamics, vegetation, and wildlife characteristic of the Chesapeake Bay salt marsh ecosystem (CENAB, 2009a; CENAB, 2009b; USACE, 2006). Construction of the island began in 1998 and completion is expected by 2027 (USACE, 2006). Plans are to use approximately 38 million cubic yards of uncontaminated dredge material (Dalal and Baker, 1999). In 1997, a Project Cooperation Agreement was executed with the State of Maryland with the project to be cost-shared 75 percent federal and 25 percent non-federal with the current project cost estimated at approximately $667 million (CENAB, 2009b; USACE, 2006).

Poplar Island is isolated and human activity restricted to allow wildlife colonization and expansion in the archipelago (CENAB, 2009b). Additionally, the removal of foxes and raccoons, dominant terrapin nest predators, creates an ideal environment. Therefore, Poplar Island Environmental Restoration Project is unique because major predators are absent, which allows for a large detailed study of terrapin nesting ecology and how their populations respond to newly formed habitat via either natural or anthropogenic means. On Poplar Island, diamondback terrapin nests are found primarily along the east side on sandy strips (Cell 3, the notch, Cell 5,) and a few along the inside perimeter of Cell 6. These elevated nesting areas were built from sand that was mined from the sight.

Study Species: Diamondback terrapin, Malaclemys terrapin

The only turtle in North America that lives exclusively in estuaries is the diamondback terrapin, *Malaclemys terrapin* (Klemens, 2000). There are only two other exclusively estuarine turtles are *Batagur baska* and *Callagur borneoensis,* both found in Asia in tropical climates. The terrapin has one of the greatest geographic distributions for a turtle and may be found in a variety of habitats throughout their range (Roosenburg, 1994). Seven subspecies are found from Cape Cod, Massachusetts to Corpus Chrisi, Texas (Ernst et al., 1994). The northern diamondback terrapin is found from Cape Cod, Massachusetts to Cape Hatteras, North Carolina (Ernst et al., 1994). Diamondback terrapins evolved in coastal habitats and with the retreat of the last glaciations, expanded their range northward and inland (Roosenburg, 1994).

While terrapins require a whole suite of habitats to complete their lifecycle, they spend most of their life in water and come ashore to nest (Roosenburg, 1991; Roosenburg, 1994). Terrapins are found in salt marshes, tidal creeks, estuaries, and lagoons that lie behind barrier islands (Ehret and Werner, 2004; Roosenburg, 1991). However, terrapins in Florida are primarily found in lagoons (Roosenburg, 1994), while terrapins in New Jersey, Delaware and Maryland are found in channels and salt marshes (Roosenburg, 1994). In order to successfully reproduce, terrapins must cross the intertidal zone and place their nests above the mean high tide line (Roosenburg and Place, 1995).

Throughout their range, terrapins nest in a variety of habitats above the high water mark (Roosenburg, 1994; Roosenburg et al., 2003). In the Chesapeake, inland populations nest in open sandy patches above the mean high water. Coastal populations nest on large sand dunes that offer open sandy habitats (Roosenburg and Dunham, 1997; Roosenburg, 1994). Diamondback terrapins are iteroparous, nesting as many as three times during the nesting season (Roosenburg and Dunham, 1997). They are also philopatric, nesting on the same beach within and among years (Roosenburg, 1991). Terrapins will utilize suitable habitat when it is available because they are opportunists (Roosenburg, 1991). Terrapins dig small flask shaped chambers and deposit an average of 13 eggs in the Chesapeake Bay region. Terrapins exhibit temperature-dependent-sex-determination (Roosenburg and Place, 1995).

Terrapins play an important role in estuaries. Terrapins feed primarily on filter feeders including soft and hard shell clams, razor clams, oysters, mussels, and barnacles (Bauer, 2004). These filter feeders consume plankton and zooplankton. Terrapins also consume browsers and detritivores such as whelks, marine worms, several species of crabs, and intertidal snails (Bauer, 2004). Terrapins prey on periwinkle snails which feed off of fungi that grow on salt marsh stems. If left unchecked, periwinkle snails will overgraze on and kill salt marsh grasses(Silliman and Bertness, 2002). Therefore, terrapins are potentially a keystone predator because they directly affect snail densities, distribution, abundance and diversity of the salt marsh community (Silliman and Bertness, 2002).

Terrapins are preyed on by a whole variety of predators throughout their lifecycle. Nests are preyed upon by beach grass as roots grow into eggs (Lazell and Auger, 1981; Stegmann et al., 1988), fungi (Auger and Giovannone 1979), flies (Auger and Giovannone 1979), birds (*Larus* sp.) (Watkins-Colwell and Black 1997), ghost crabs (*Ocypode quadrata*) (Zimmerman, 1992), raccoons (Seigel, 1980), and foxes. Hatchlings' predators are fish, birds (*Larus* sp.) (Watkins-Colwell and Black 1997), raccoons (*Procyon lotor*) (Seigel, 1980), Roosenburg and Place, 1995), and foxes (*Vulpes vulpes*) (Burger, 1977). Adults are preyed upon by raccoons and bald eagles (Clark, 1982). Raccoons are predators of all age classes of *M. terrapin,* including adult females. Raccoons catch and kill adult females while they're nesting to get their eggs (Roosenburg personal communication). Raccoons are a highly generalized nocturnal predator found in the eastern half of North America (Klemens, 2000). They are predators of eggs, hatchlings, adults or some combination for at least 58% of North American turtles and are considered the single most significant predator of turtles in North America (Klemens, 2000; Ernst et al., 1994). High densities of predators present increase mortality rates in turtle populations (Klemens, 2000). Roosenburg observed nest predation rates at two beaches on the Patuxent River in Maryland from 1987 to 1991, to average 83.5% at high density nesting beaches and 41.3% at a low density beaches. Predation at the first beach reached 95% in 1987 and 1988. Raccoons were the major nest predators (Roosenburg, 1991).

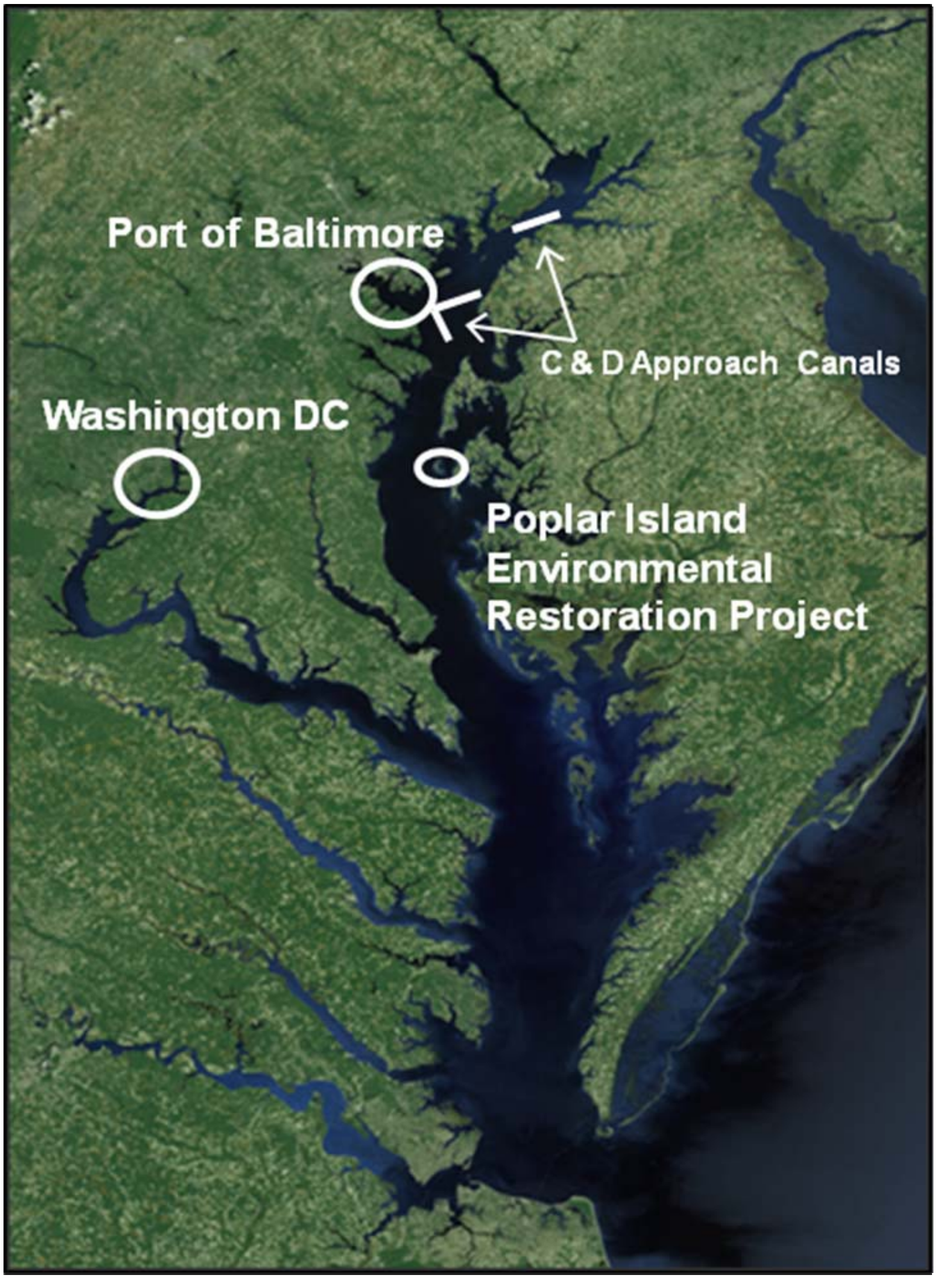

Figure 1. Poplar Island and dredge material location from Chesapeake and Delaware Approach Canals in the Chesapeake Bay (NASA, 2008).

Figure 2. Diamondback terrapin nesting habitats on Poplar Island; Cell 3 beach, the "notch", Cell 5 beach, and the inside perimeter of Cell 6 (Ariel photo CENABa, 2009 courtesy W.M.R.).

Poplar Island Field Methods

Diamondback terrapins began to nest on Poplar Island after the completion of the perimeter dike in 2002 (Roosenburg and Allman, 2003). Terrapin surveys taken from 2004 – to present have been consistent and detailed. Survey techniques and methods used for 2004-2007 nesting seasons are described in detail (Roosenburg et al., 2004, 2007, 2009; Roosenburg and Sulllivan 2006) and described herein briefly.

Daily surveys of terrapin nesting areas occurred from May 15 - August 1, 2007 in the following areas: the notch area (near Cell 4), areas between Coaches Island and the PIERP (outside of Cell 5), inside the open upland cell (Cell 6), and the beach outside the dike in Poplar Harbor (outside Cell 3) (Figure 2). Subtle changes in ground cover and terrapin tracks were used to locate nests. Once found, recent nests less than 24 hours old (indicated by the eggs' pink appearance) were excavated, weighed, and counted to obtain clutch size and egg mass. Eggs were then returned to original nest chamber and covered. Nests older than 24 hours (indicated by eggs' white appearance) were not excavated to prevent damage to the embryo. Geographic positioning system (GPS) recorded all nest positions. Beginning in 2006, nests were covered with antipredator 30 cm by 30 cm, 1.25 cm^2 wire mesh screens that were held in place by 4 survey flags. Screens were used to deter avian nest predators, primarily crows.

Monitoring nesting and hatching success:

After 45 – 50 days of incubation individual nests were encircled with an aluminum flashing ring to catch hatchlings and a 1.25 cm^2 wire mesh was placed over the ring to prevent avian predation. Once ringed, nests were checked daily for newly emerged hatchlings. The hatchlings were then taken to an on-site laboratory facility where they were measured (carapace, plastron, width, and height), notched (marked marginal scutes for the cohort year), and tagged (a coded wire tag) (Roosenburg and Allman, 2003). Nests in Cell 5 and the notch, that did not have any hatchlings emerge in the fall, were left to overwinter with aluminum flashing ring and antipredator cage. All other nests in Cell 6, and Cell 3 were excavated by October 31.

Ten days after emergence of the last hatchling, researchers excavated nests and recorded the number of live hatchlings, dead hatchlings that remained, eggs with dead embryos, and eggs that showed no signs of development. Hatching success was determined by comparing the number of surviving hatchlings to the total number of eggs from only the nests that were excavated at ovipoisition. Nests that over-wintered were excavated early spring to determine fate of nests.

Measuring, tagging, and release of hatchlings:

All hatchlings were brought to the Maryland Environmental Service (MES) shed onsite and were placed in plastic containers with water until they were processed (measured, notched, and tagged) within 24 hours of capture (Roosenburg et al., 2009). Hatchlings were marked by marginal scute notching with a scalpel with a unique series for each cohort. Coded wire tags (CWTs, Northwest marine Technologies) were implanted in all hatchlings. The CWTs were placed subcutaneously in the right rear limb using a 25-gauge needle. The CWTs allow for long-term identification of the turtle by detecting tag presence or absence using Northwest Marine Technologies V-Detector.

Plastron length, carapace length, width and height (± 0.1 mm) and mass ± 0.1 g) were measured on all hatchlings. Anomalous scute patterns and other developmental irregularities were recorded. Hatchlings were released in Cell 4DX or Cell 3D. Institutional Animal Care and Uses Committee at Ohio University (IACUC) approved animal use protocols (#L01-04) and Maryland Department of Natural Resources (MD DNR) Fisheries Division issued a Scientific Collecting Permits to Willem M. Roosenburg (WMR).

Statistical Analysis

Significance of statistical analyses was accepted at $P < 0.05$. Data were processed using Microsoft Excel and Sigma Plot and statistical analyses were conducted using Statistical Analysis Systems (SAS) and R.

Results

Terrapins use available and accessible nesting areas on Poplar Island since 2002 (Figure 2). Nesting occurs along the beach of Cell 3, Cell 5, the “notch”, and inside the perimeter of Cell 6 (Figure 2). The densest nesting occurs opposite Coaches Island in Cell 5 and along the notch (Figure 3). The number of nests in each major nesting site on PIERP has changed throughout the study (Figure 4). The number of nests along Cell 5 have increased and the number of nests along the notch have decreased from 2005-2007 (Figure 4). The proportion of nests surviving in each nesting area is consistent among years (Figure 4).

The total number of nests on Poplar Island have increased since the beginning of the monitoring program from 68 in 2002 to a peak of 282 nests in 2005 (Table 1).

Recently about 200 nests are found every year. Depredation increased from 2005 and 2006 then decreased in 2007 (Table 1).

Nests are only allowed to overwinter along the notch and Cell 5 due to logistics of monitoring all nesting areas throughout the year. All other nests are excavated in late October at which terrapin nest fate was determined and recorded. Looking at nest fate and overwintering percentage between 2006 and 2007 in the notch and Cell 5, the nests destroyed before fall emergence decreased from 2006 to 2007, hence the number of fall emerging nests increased in 2007 (Table 2). The proportion of nests that overwinter on Poplar Island along the notch and Cell 5 is about 30% each year (Table 2). There was one nest in 2006 that had both fall and spring emerging hatchlings.

There was a lay date effect on lipid levels in hatchlings in 2005, where nests laid later in the season had higher energy reserves than nests laid earlier in the season (ANOVA, $F_{1,28} = 7.65$, $P < 0.01$). There was no difference in lipid mass between fall and spring emerging hatchlings and lay date does not appear to affect emergence time (Figure 5).

There is no difference in the mean within nest survivorship (the proportion of eggs that were laid verses the number of hatchlings that were produced) between fall and spring emerging nests, from 2004-2007 (ANOVA, $F_{1,406} = 2.75$, $p > 0.05$; Figure 6). There was a year effect (ANOVA, $F_{3,406} = 8.63$, $p < 0.05$; Figure 6) with the lowest survivorship in 2005. There was no year by season interaction (ANOVA, $F_{3,406} = 1.7$, $p > 0.05$; Figure 6).

There is no effect of lay date on emergence time (fall or spring) in 2005 and 2007. A Wilcoxon rank sum test with continuity correction was used for 2005 and 2007 (2005: $W = 1464.5$, p-value > 0.5; $N=128$ fall emerged nests, $N= 23$ spring emerged nests, 2007: $W = 2933$, p-value > 0.5; $N= 108$ fall emerged nests, $N=50$ spring emerged nests; Figure 7). However there was a lay date effect in 2006 where nests laid early in the season emerged in the fall compared to nests laid later in the season, which emerged in the spring Wilcoxon rank sum test with continuity correction ($W = 694$, p-value < 0.05; $N=62$ fall emerged nests, $N=30$ spring emerged nests; Figure 7)

Figure 3. Terrapin nesting locations from 2002- 2007. More recent years are on the bottom, overlapped by earlier nesting season years. (Ariel photo CENABa, 2009 courtesy W.M.R.).

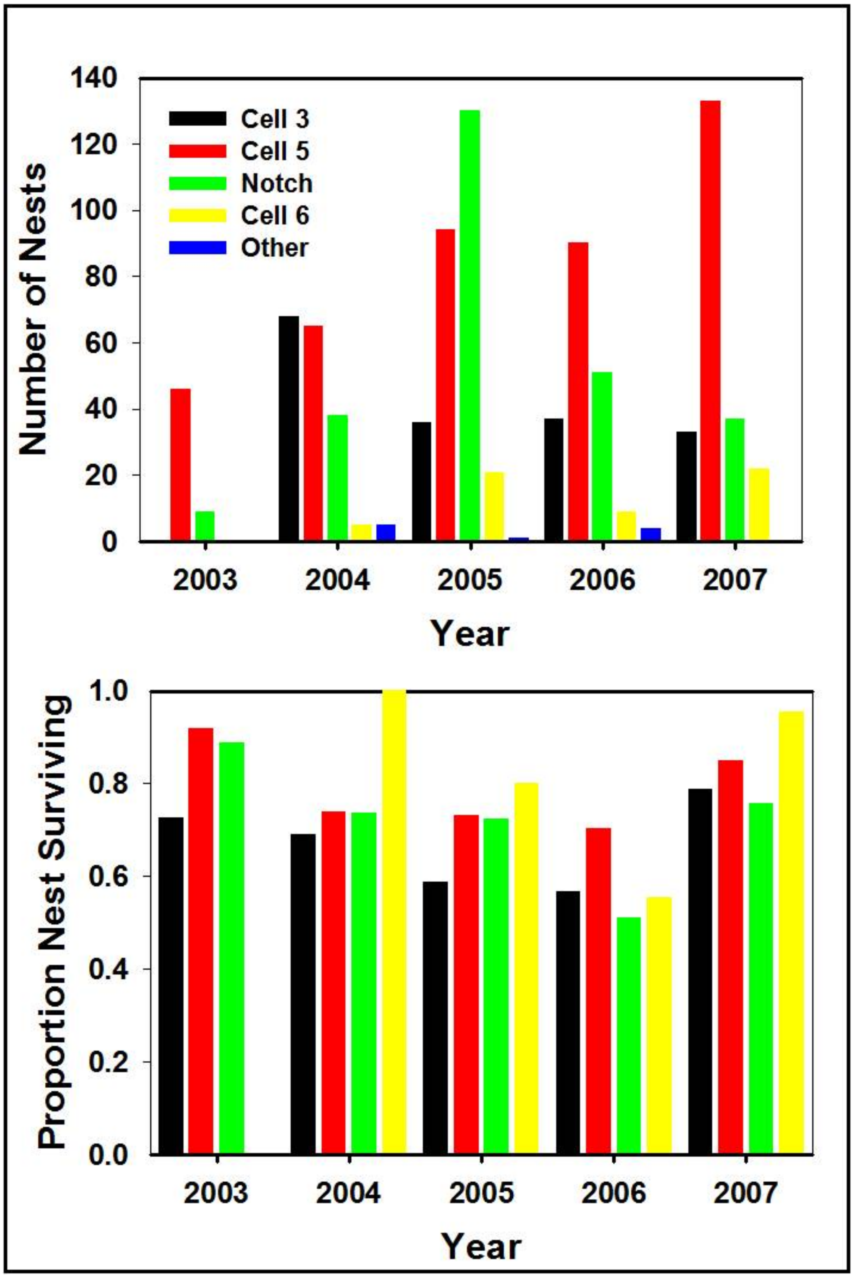

Figure 4. The number of nests in each of the major nesting areas for each year of the study and the proportion of nests surviving.

Table 1

Poplar Island Terrapin Nest Fate 2002-2007

Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Total nests	68	67	182	282	191	225
Nests produced hatchlings	38	50	129	176	112	166
Nests that did not survive	1	7	17	70	69	44
Depredated (roots or animal)	0	0	12	46	54	18
Washed out	1	6	3	11	13	2
Undeveloped, weak shelled eggs, or dead embryos	0	1	0	12	1	19
Destroyed by a turtle or nest was in rocks	0	0	0	1	0	0
Destroyed by bulldozer	0	0	0	0	1	2
Dead hatchlings	29	10	36	36	10	19

Table 2

Nest Fate and Overwintering Percentage

Year	**2006**	**% 2006**	**2007**	**% 2007**
Total Nests (notch and Cell 5)	146		170	
Depredated nests and nests destroyed before fall emergence	47	32.2%	18	10.6%
Fall emerging nests	49	33.6%	92	54.1%
Nests overwintering	44	30.1%	60	35.3%
Spring emerging nests	33	22.6%	50	29.4%
Overwintering nests that did not emerge	6	13.6%	4	2.4%
Unknown nests	11	7.5%	6	3.5%
Both fall and spring emerging nests	1	0.7%	0	0%

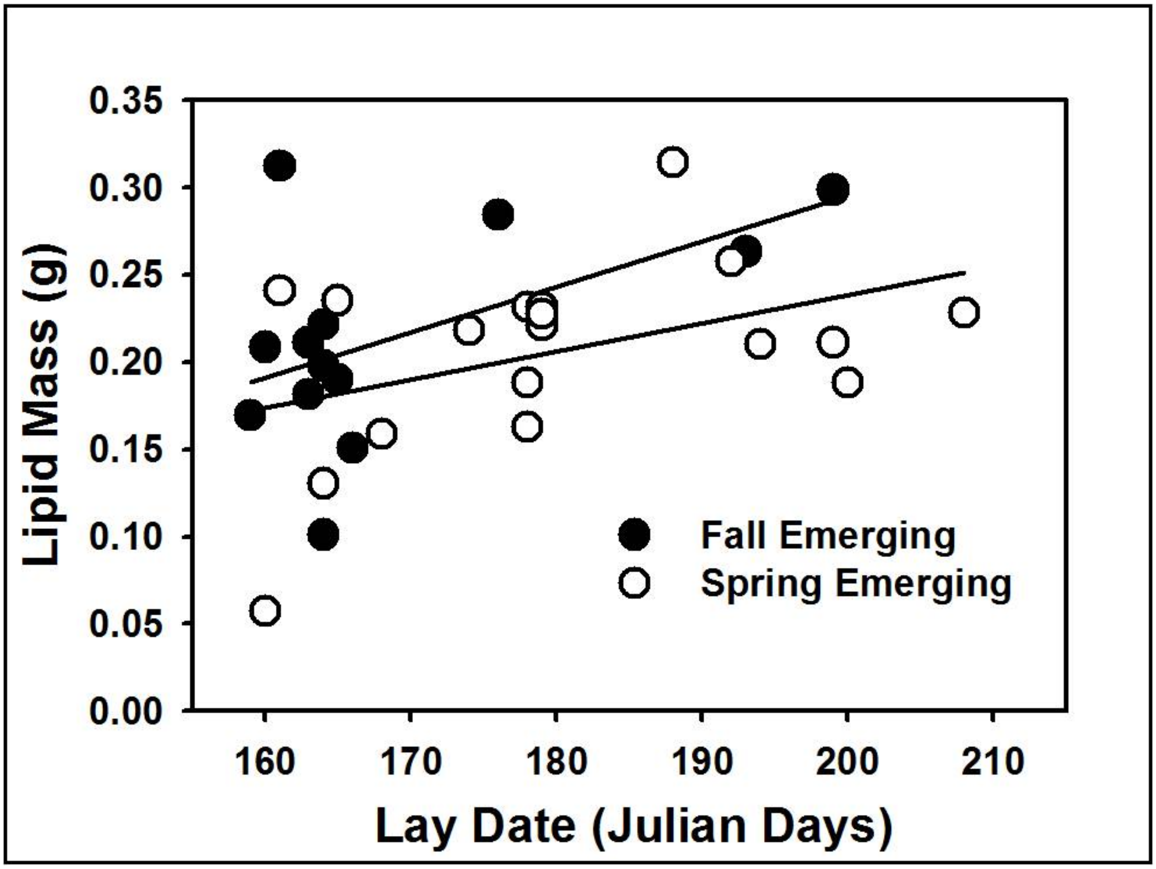

Figure 5. 2005 Lipid levels of hatchlings from the PIERP comparing fall emerging and spring emerging individuals. There was a lay date effect on energy reserves ($F_{1,28} = 7.65$, $P < 0.01$)

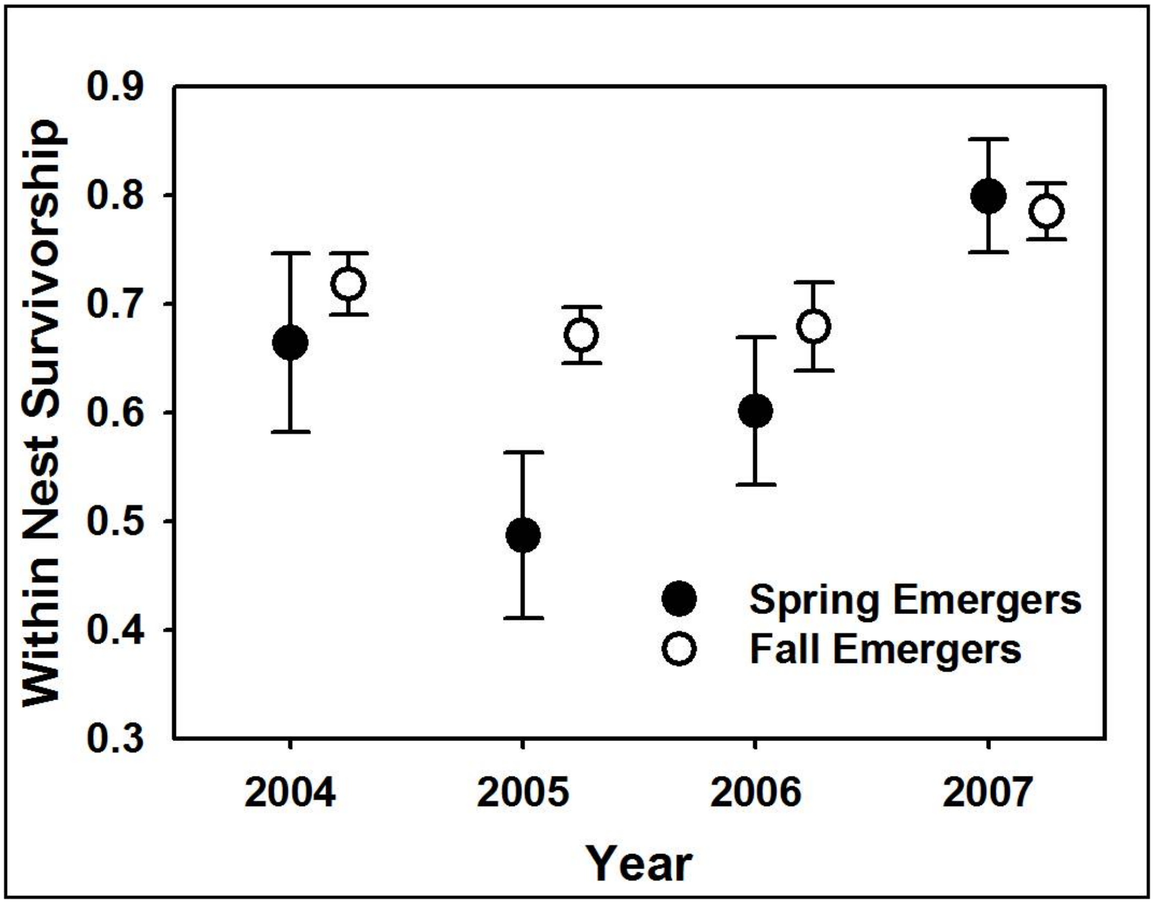

Figure 6. Differences in survivorship between fall emerging and spring emerging nest from 2004 -2007 on the PIERP. ANOVA test shows there was no season effect ($F_{1,406} = 2.75$, $p > 0.05$). There was no significant year effect ($F_{3, 406} = 8.63$, $p < 0.05$), and no year by season interaction ($F_{3,406} = 1.7$, $p > 0.05$).

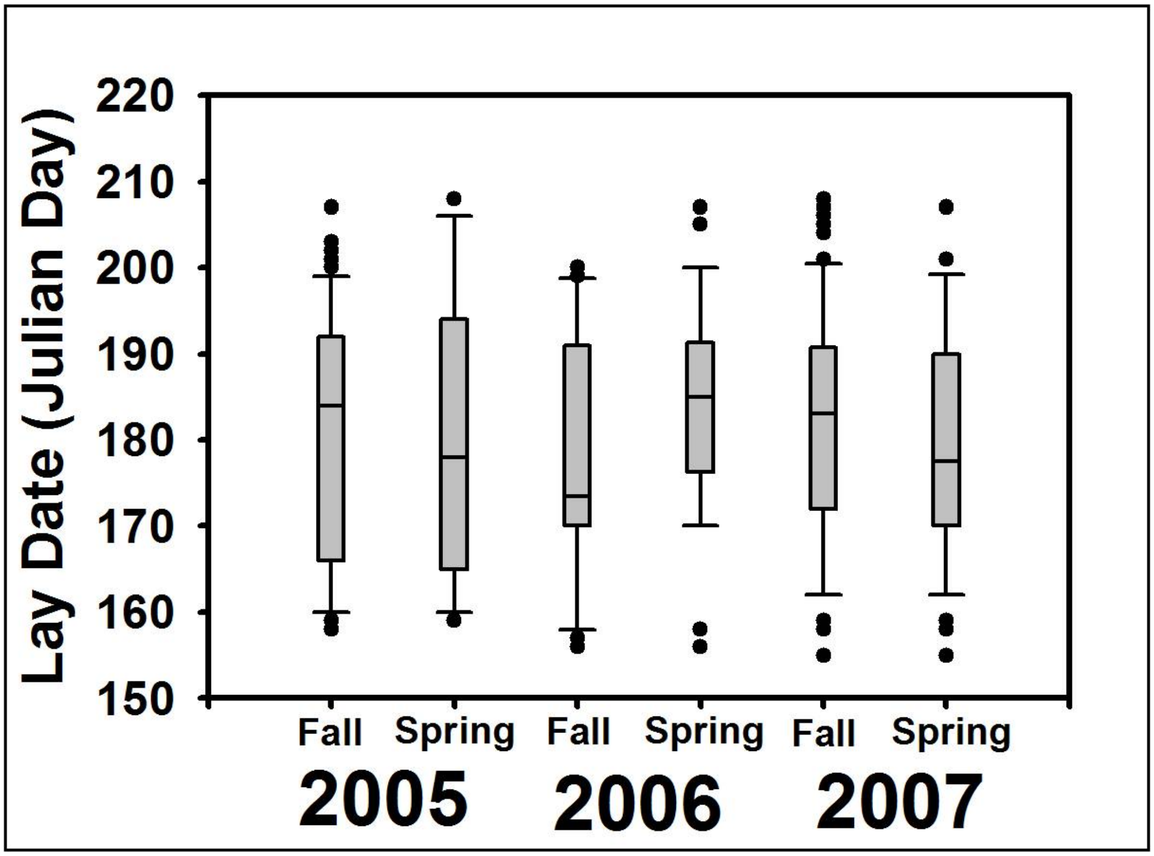

Figure 7. Lay date of fall and spring emerging nests for PIERP 2005-2007 nests. There was no lay date difference between fall and spring emerging hatchlings in 2005 and 2007 however there was a lay date effect on emergence time in 2006. A Wilcoxon rank sum test with continuity correction was used for 2005 and 2007 (2005: W = 1464.5, p-value > 0.5; N=128 fall emerged nests, N= 23 spring emerged nests, 2007: W = 2933, p-value > 0.5; N= 108 fall emerged nests, N=50 spring emerged nests). A Wilcoxon rank sum test with continuity correction was used in 2006(W = 694, p-value < 0.05; N=62 fall emerged nests, N=30 spring emerged nests).

Discussion

Hundreds of cubic meters of sediment are dredged each year for commercial and recreational purposes which are then expelled into oceans, estuaries, rivers and lakes, or to land-based disposal facilities (Costa-Pierce and Weinstein, 2002). Opening new containment sites creates social and economic conflicts and presently, dredged material containment facilities are nearing capacity or are already full (Costa-Pierce and Weinstein, 2002). However, uncontaminated dredge materials are a valuable resource and can be used to create wildlife habitat islands and stabilize and restore beaches and wetlands (Costa-Pierce and Weinstein, 2002). Dredge material islands can be found throughout the Great Lakes, Pacific Coast, and in estuaries worldwide (Yozzo et al., 2004). Along the US Atlantic and Gulf Coast, over 2,000 dredge material islands can be found (Yozzo et al., 2004). Dredge material islands are used by shorebirds and wading birds as nesting areas and rookeries (Yozzo et al., 2004; Spear et al., 2007; Erwin and Beck, 2007; Piesschaert et al., 2005). Most of the research on dredge material island habitat has focused on population and community levels of avifauna (Yozzo et al., 2004; Spear et al., 2007; Erwin and Beck, 2007; Piesschaert et al., 2005). Few studies have focused on the use of dredge material habitat for reptiles, in particular chelonians. The PIERP terrapin study is the first to document the use of dredge material islands as creating suitable and possibly important habitat for turtles.

The Poplar Island Environmental Restoration Project (PIERP) is a unique opportunity to understand how large-scale ecological restoration projects affect terrapin populations and turtle populations in general. Since 2002 the long-term terrapin monitoring project has been conducted on Poplar Island to document terrapin nesting. By monitoring the terrapin populations on the PIERP, resource managers can understand how new habitat affects terrapin populations as well as understand how to create new terrapin nesting and juvenile habitat (Roosenburg et al., 2009). This information will contribute to understanding the ecological quality of the restored habitat on the PIERP, as well as understanding how terrapins respond to large-scale restoration projects (Roosenburg et al,. 2009). The results of five years of terrapin nesting surveys reveals how diamondback terrapins use habitat created by the PIERP and how it has changed during that time.

This study surveyed potential nesting areas and followed nest fate throughout development to determine hatching success and hatchling quality. Terrapins began to use newly formed habitats for nesting after the perimeter dikes of Poplar Island were completed in 2002 (Roosenburg and Allman 2003; Roosenburg and Sullivan, 2006; Roosenburg et al., 2009; 2007; 2004). Nesting was restricted to areas where terrapins could access nesting sites. The stone dike around Poplar is a barrier that prevents terrapins from accessing many potential nesting sites (Roosenburg et al., 2004). Results show an increase in terrapin nests from 2002-2005 with a peak of nests in 2005. The number of nests per year now averages around 200 nests on Poplar, with the highest nesting density occurring opposite Coaches Island along Cell 5 and the notch. Terrapin nesting and juvenile habitat in the Poplar Island archipelago were reduced due to erosion (Roosenburg and Allman, 2003). Therefore, before Poplar Island Environmental Restoration Project (PIERP) began, terrapin populations in the area likely declined due to the emigration of adults and potentially reduced recruitment because of limited high quality nesting habitat (Roosenburg and Allman, 2003). Even alteration or damage to these habitats could negatively affect population dynamics (Roosenburg and Place, 1995). Results show that terrapins started using a suitable habitat as soon as it was formed. The newly restored wetlands could provide the resources that would allow terrapin populations to increase by providing high quality juvenile habitat (Roosenburg and Allman, 2003).

The proportion of nests surviving is consistent from year to year, with the highest survivorship occurring in Cell 6, then Cell 5, and lastly the notch. There is an increase in the number of nests in Cell 5 from 2005-2007 with a decrease in the number of nests occurring on the notch from 2005-2007. Suitable nesting habitat may become less available as more beach grass grows along the notch area. Increasing vegetation decreases terrapin nesting habitat in addition to making it more difficult to find nests.

Nest predation rates increased in 2005 and 2006 and then decreased in 2007. Fish crows began preying upon nests in 2005, in mid 2006 we began to protect nests by laying wire mesh over the nest and burying it less than 1cm. Protecting nests in this manner was adopted at the beginning of the nesting season in 2007 contributing to the high nest success during that year. Terrapins are preyed on by a whole variety of predators throughout their lifecycle. On Poplar Island nests are preyed upon by: beach grass (*Spartina* sp.), crows (*Corvus* sp.), corn snakes (*Elaphe gutta*), shrews, and ants (Roosenburg personal communication). Juveniles are preyed upon by shorebirds, wading birds and fish (Roosenburg personal communication). On Poplar raccoons are not present. While bald eagles are present on the island, predation of adult terrapins has not been observed.

The percentage of nests that overwinter every year is about 30%, with almost the same emerging in the fall. Some nests are simply lost due to a number of reasons and their fate remains unknown. While one nest in 2006 exhibited both fall and spring emergence in one clutch, this is probably atypical. Only one hatchling from the nest emerged in the fall, while the rest of the clutch remained inside the natal nest to overwinter. Nests are only allowed to overwinter along cell 5 and the notch. Due to logistical factors all other nests are dug up at the end of fall to determine nest fate.

Hatchling lipid mass did not differ between fall and spring emerging hatchlings indicating there is neither an increased energy used or saved between the two overwintering strategies. Interestingly, lay date did affect lipid levels indicating that increased duration within the nest during the warm incubation period increases energy consumed by the hatchling, but regardless of lay date sufficient energy reserves remain for the hatchling to overwinter in the nest. Furthermore, these results indicate that lay date is not an important component in determining whether a nest overwinters or not. Gibbons and Nelson (1978) suggested that in species with facultative overwintering that earlier nests may be more likely to emerge in the fall and that nests laid later in the season would be more likely to overwinter. Our data does not support this hypothesis.

We also evaluated potential lay date using the multi-year data set from the notch and Cell 5. Again, overwintering does not appear to be determined by lay date (spring emerging hatchlings are laid throughout the entire nesting season).There is no effect of lay date on emergence time (fall or spring) in 2005 and 2007. However there was a lay date effect in 2006 where a greater proportion of nests laid early in the season emerged in the fall and those laid later emerged in the spring. Late season oviposition could result in insufficient number of days to complete embryonic development, and thus may affect emergence timing (Gibbons and Nelson, 1978). Our results indicate that date of oviposition's effects on emergence timing differ year to year. I therefore conclude that an internal clock set by date of oviposition does not stimulate nest emergence in *M. terrapin* hatchlings.

As results have shown, parts of Poplar Island are excellent terrapin nesting habitat, as indicated by the large number of nests, high nest survivorship, and high hatchling rate (Roosenburg et al., 2009). Poplar is unique because major nest predators such as raccoons and foxes are controlled, allowing for a much higher nest survivorship than normal. Also the lack of predators reduces the risk of predation for nesting females. The initial success of terrapin use on Poplar Island indicates that similar projects may create terrapin nesting habitat (Roosenburg et al., 2009). One of the major factors threatening terrapin populations throughout their range is the loss of nesting habitat to development and shoreline stabilization (Roosenburg, 1991; Siegel and Gibbons, 1995). Projects such as Poplar Island that combine the beneficial use of dredged material and ecological restoration have the potential to create habitat similar to what has been lost to erosion and human practices. With proper management, areas such as Poplar Island Environmental Restoration Project may become areas of concentration for terrapins and thus provide a source population for the terrapin recovery through out the Bay.

CHAPTER 2: TERRAPIN OVERWINTERING ECOLOGY

Winter is a time of physiological stress during which organisms employ a variety of survival strategies. Ectotherms most frequently try to overwinter in habitats where they can avoid freezing or they have unique adaptations that allow them to avoid the physiological stress of freezing. Most turtles avoid cold injury by retreating to habitats that do not freeze, and adult terrestrial turtles pass the winter underground in burrows (Utlsch, 2006). Aquatic turtles often burrow into the soft sediments of their aquatic habitat avoiding the freezing temperatures that occur near the surface (Utlsch, 2006). However, hatchlings of many aquatic species overwinter terrestrially (Draud et al., 2004; Packard and Packard, 2003), and when confronted by sub-zero temperatures, they use two methods to avoid injury from cold: supercooling and freeze tolerance (reviewed in Costanzo et al., 2008). In some species hatchlings emerge from the nest in late summer and early fall after completing embryonic development (e.g. snapping turtle *Chelydra serpintine*) while other species spend the winter as fully developed hatchlings in their natal nests and delay emergence until the spring (e.g. painted turtle *Chrysemys picta*; Gibbons and Nelson, 1978). Fall emerging hatchlings still overwinter terrestrially and must burrow into the sand to avoid cold injury (Draud et al., 2004; Draud, 2007).

Delayed emergence has been confirmed for five turtle families (Gibbons and Nelson, 1978; Costanzo et al., 1995; Ultsch, 2006). The benefits of late summer or fall emergence include the potential to immediately initiate feeding and growth (Gibbons and Nelson, 1978). The costs of immediate emergence include exposure to predators, inability to find suitable hibernating spots before the onset of cold weather, drying of aquatic habitats, and decreasing resources. On the other hand, delayed emergence and overwintering in the natal nest provides a period of growth and a sanctuary to avoid predation and emerge in an environment with increasing resources (Gibbons and Nelson, 1978; Ultsch, 2006).

Reasons for delayed emergence include the lack of rainfall and low temperatures (Gibbons and Nelson, 1978). Adverse ground conditions were observed to prevent emergence of *C. picta* in the fall and that rains are needed in the spring for ground softening (Hartweg, 1944; Gibbons and Nelson, 1978; DePari, 1996). Overwintering of clutches laid late in the nesting season may experience an insufficient number of warm days during the summer months in northern latitudes to emerge in the fall and hatchlings remain in the nest until the following spring (Gibbons and Nelson, 1978). Some species potentially delay emergence to avoid high environmental variability and uncertainty that exists for hatchlings that emerge in the fall (Gibbons and Nelson, 1978). Natural selection could favor individuals who use environmental cues (such as temperature or rainfall) to emerge facultatively during favorable conditions. Environmental cues (temperature or rainfall) were used by *Graptemys geographica* hatchlings to emerge into an environment with increasing natural resources (Nagle et al., 2004). Hatchlings may emerge in the fall if conditions for successful overwintering are lacking, suggesting that physiological mechanisms of cold tolerance and neonatal energy reserves are potential factors affecting delayed emergence (Nagle et al., 2004). Fall emergence maybe a response to poor structural or physical conditions that provide poor overwintering hibernacula (Nagle et al., 2004). The objective of this study is to compare environmental parameters of fall and spring emerging nests of the diamondback terrapin (*Malaclemys terrapin*). Terrapin hatchlings delay emergence facultatively and thus they are an excellent model system to study potential causal mechanisms for emergence in hatchling turtles. Understanding this early life cycle stage for terrapins may help develop accurate ecophysiological models (Gibbons et al., 2001) that can help understand population dynamics and species distributions (Costanzo et al., 1995).

Emergence Timing in Hatchlings

Turtles are long lived reptiles that are successful in a variety of environments where they are exposed to extreme conditions such as dehydration, heat, cold, and hypoxia (Costanzo et al., 2008). The extreme conditions hatchlings must endure in the winter such as dehydration and injury from cold, has especially intrigued field biologists (Wyneken et al., 2008). In temperate species of turtles, eggs hatch in late summer and autumn (Costanzo et al., 2008). While some hatchlings emerge from the natal nest to seek other hibernacula, some species remain inside the natal nest (Costanzo et al., 2008). Timing of nest emergence is “different among taxa, populations, and even siblings sharing the same nest” (Costanzo et al., 2008).

As a strategy, “delayed emergence” occurs in five families and is practiced by 19 species, including *Malaclemys terrapin* (Gibbons and Nelson, 1978). There are a number of factors in the literature which may influence hatchling emergence timing in chelonians. Biological factors include internal timing and evolutionary response. Physical cues include; rainfall, temperature, nest entrapment, suboptimal incubation, and suboptimal hibernacula. However, there is little consensus about which of these factors is of greatest importance in emergence timing (Costanzo et al., 2008). Studies have shown that rainfall can influence emergence timing in three ways: 1) nest emergence happens to coordinate with precipitation due to the increase in soil moisture (Nagle et al., 2004); 2) rainfall could stimulate emergence by softening the soil (Wyneken et al., 2008); and 3) precipitation could flush out carbon dioxide from the nest and increase oxygen needed for locomotor activity (Costanzo et al., 2008; Wyneken et al., 2008). Temperature gradients in the soil could be a cue to synchronize emergence; where warmer temperatures encourage emergence and colder temperatures may induce overwintering. Nest entrapment is another physical cue, or barrier, that influences nest emergence timing. Studies have shown that nest emergence does not occur until rains have softened the soil in the spring after hatchlings have been forced to overwinter from the previous autumn due to hardened ground conditions (DePari 1996, Hartweg, 1944; Tinkle et al., 1981; Costanzo et al., 2008). Suboptimal incubation due to the physical characteristics of the nesting soil can affect emergence timing. Hatchlings may be developmentally immature and unprepared to leave the nest in autumn and therefore overwinter in the nest until the following spring. Suboptimal overwintering conditions such as flooding or degradation of the nest chamber may cause emergence in hatchlings (Costanzo et al., 2008; Nagle et al., 2004). Terrapin hatchling overwintering and facultative emergence has been observed on Polar Island, an environmental restoration project located in the middle Chesapeake Bay, since 2002 (Roosenburg et al., 2003).

Physiology of Overwintering and Soil

Survival of ectothermic animals at subzero temperatures depends on physiological and biochemical characteristics known as “cold hardiness” (Willmer et al., 2005; Schmidt-Nielson, 1997). Ectotherms use two general strategies for dealing with potential freezing of contained water: freeze tolerance and freeze intolerance (Willmer et al., 2005). Freeze tolerance is the ability to recover from extensive ice formation within the body (Willmer et al., 2005). Freeze tolerance is when ice forms and is limited to cellular spaces (Wyneken et al., 2008). Therefore, animals that use the freeze tolerance strategy depend upon ice inoculation at high subzero temperatures and a relatively slow cooling rate to limit ice to extra cellular spaces (Wyneken et al., 2008). Freeze intolerance is the ability to avoid ice formation in temperatures as low as -40° C to -50° C (Willmer et al., 2005). One way to avoid ice formation is to cool a liquid below its freezing point without it solidifying, known as supercooling (Packard and Packard, 2003; Willmer et al., 2005). Another way to avoid ice formation is to use antifreeze compounds that lower the freezing point without affecting the melting point (Schmidt-Nielsen, 1997). Most polar fish use antifreeze compounds in their blood and tissue fluids, which prevent the growth of ice crystals (Schmidt-Nielsen, 1997). Fish and most derived vertebrates are freeze intolerant (Schmidt-Nielsen, 1997). Along with many invertebrates, some amphibians (*Hyla versicolor*) and reptiles (*Chrysemys picta*) survive and tolerate ice formation (Schmidt-Nielsen, 1997). Whether turtles survive overwinter conditions by supercooling or freezing is debated (Packard and Packard, 2003; Costanzo et al., 2000; Storey and Storey, 1992). More recently, it has been stated that both survival methods may promote survival in *Chrysmes picta* hatchlings (Costanzo et al., 1995). Studies on microenvironmental conditions and the effects that substratum has on hatchling survivorship may add insights about overwintering in turtles (Costanzo et al., 1995).

Any contact with ice would be lethal for a supercooled animal (Packard and Packard, 2001; Costanzo et al., 1995). Therefore, death by freezing in supercooled animals depends on temperature, presence of nuclei for ice formation, and time. When ice forms in an animal that has been supercooled, the crystals grow rapidly and cause extensive damage, puncturing cell membranes and disrupting subcellular structures and causing death (Schmidt-Nielsen, 1997). Ice is formed when a nucleus promotes organization of water molecules into an ice crystal lattice (Zachariassen and Kristiansen, 2000). The initial freezing is termed ice nucleation (Zachariassen and Kristiansen, 2000).

Ice nuclei form two ways: homogenous nucleation and heterogeneous nucleation (Lee and Costanzo,1998). Homogenous nucleation is the spontaneous aggregation of water molecules. The chance of aggregation increases with decreasing temperatures and the duration of chilling (Lee and Costanzo, 1998). Heterogeneous nucleation is when some other body, other than water, is the template where an ice crystal can form (Lee and Costanzo, 1998). These ice nucleating agents provide a place where water molecules congregate to form a nucleus where an ice crystal can grow; such as bacteria, fungi, and mineral crystalloids (Lee and Costanzo, 1998). The likelihood of ice nucleating agents in hatchlings depends on body temperature and various attributes of surrounding soil (Costanzo et al., 1998). Nesting soils host many ice nucleating agents which include organic, bacteria and fungi, and inorganic, crystalloids (Costanzo et al., 2000).

Soil moisture has a strong influence on inoculation risk, because it determines the abundance of crystals in the vicinity of the turtle (Baker et al., 2006). Soil texture is also an important variable for overwintering hatchlings. Some ectotherms avoid ice inoculation better if the frozen substrate contains clay or organic matter which can absorb water and reduce the formation of ice in the pore space of soils (Costanzo et al., 1998). Moisture content, texture, and porosity directly or indirectly influence the abundance and distribution of ice within the substratum matrix (Costanzo et al., 1998). The presence of potent ice nuclei in nesting soils may impact winter survival demographics and geographic distribution of *C. picta* (Costanzo et al., 2000).

Materials and Methods

Study Species: Diamondback Terrapin, Malaclemys terrapin

The diamondback terrapin, *Malaclemys terrapin,* is an emydid turtle found along the United States eastern seaboard. Seven subspecies are found from Cape Cod, Massachusetts to Corpus Christi, Texas (Ernst et al., 1994). The northern diamondback terrapin, *Malaclemys terrapin terrapin* is found from Cape Cod, Massachusetts to Cape Hatteras, North Carolina (Ernst et al., 1994). Diamondback terrapins evolved in coastal habitats and with the retreat of the last glaciations expanded their range northward and inland (Roosenburg, 1994).

Throughout their range, terrapins nest on a variety of habitats above the mean high water mark (Roosenburg 1994, Roosenburg et al., 2003). In Maryland, terrapins, nest on elevated sand dunes on the coastal bays, and on narrow isolated sandy beaches found on the edges of salt marshes in the Chesapeake Bay and its tributaries (Roosenburg and Place, 1995). Terrapins can be philopatric to certain nesting areas within and among years (Roosenburg and Dunham, 1997), however they also are opportunists and will use new suitable habitat when it is available (Roosenburg, 1991). Diamondback terrapins are iteroparous, nesting as many as three times during the nesting season in the Chesapeake Bay (Roosenburg, 1991). Terrapins dig small flask shaped chambers and deposit an average of 13 eggs (Roosenburg and Dunham, 1997). Terrapins also have temperature-dependent sex determination (Roosenburg and Place, 1995). Finally, terrapin hatchlings facultatively overwinter in the nest (Baker et al., 2006) and thus the nest site selected by the female potentially have tremendous impact on the hatchling phenotype and the environment into which it emerges.

Study Site: Poplar Island Environmental Restoration Project

The Poplar Island Environmental Restoration Project (PIERP) is a large scale ecological restoration of a 450 hectare island that formerly existed in the middle Chesapeake Bay. Located near Tilghman, Maryland, the perimeter dike was completed in late 2001 and in the 2002 nesting season diamondback terrapins began to nest in the newly created habitat (Roosenburg et al., 2009). The PIERP provides a unique opportunity to study terrapin nesting ecology because mammalian nest predators are absent and therefore nest survivorship is extremely high. This allows for large sample size comparisons of fall and spring emerging nests and understanding the environmental factors that potentially influence timing of emergence.

Soil Sampling

I conducted a study to determine if a turtle's digging would disturb and alter the bulk density (soil mass per unit volume) of the soil. (Compaction raises bulk density, the amount of soil per volume g/cm^3, while loosening of the soil lowers bulk density.) After nesting season, I created, two transects along the notch and Cell 5 that were above mean high tide line creating 40 pseudo turtle nests. Nests were dug within 13-17 cm, the average nest depth of terrapins (14.98 cm ± 2.08 Montevecchi and Burger, 1975). Two flags were placed 18 cm on either side of the "pseudo nest" to relocate nests. Before retuning in the fall to take soil cores and get bulk density values, I used a computer generated random sample, to pick 20 out of the 40 pseudo nests to sample late November. I returned to collect soil cores; one soil core in the pseudo nest indicated by flags, and one core outside of the pseudo nest for a total of 20 pseudo nest cores and 20 ground cores. Ground cores were used to compare bulk density values against pseudo nest cores in order to determine if a turtle's excavation would alter the compaction of the soil.

In order to compare fall and spring emerging nests, I used a computer generated random sample, to select 20 nests that emerged in the fall and 30 nests that delayed emergence. On November 26 - 28, 2007, I took soil cores from these nesting locations using a soil corer. A 3.8 cm pipe was used to take a soil core (18 cm) from the actual nest cavity, marked by a flag (if already emerged), or metal flashing (if hatchlings had not emerged). For each nest, I collected 2 samples (core A & B). In sample analysis, the means of core A and B were used for bulk density, porosity, and organic matter content. For texture and ice nucleating agents only core A were analyzed due to time constraints.

Cores were 14 cm deep, the average depth of terrapin nests (Montevecchi and Burger, 1975, Roosenburg 1991). Labeled plastic bags stored the samples that were transported back to Ohio University for analysis. Once back at Ohio University samples were placed in brown paper bags and left to air dry before analyses were conducted.

Nest Soil Analysis

Texture

Texture was determined by hydrometer method using Stokes Law on the settling time on the percentage of sand, silt, and clay. Hydrometers are read at 40 seconds and then again in 2 hours.

Organic Matter and Bulk Density

Organic content was determined from the mass of residue remaining after incinerating samples for 550° C for 4 hours. The mean bulk density (mass per unit volume) particle density (density of solid particles only) and porosity (percentage of pore space) was measured from weight of oven dried soil samples and the known core volume.

Inorganic Ice Nucleating Agents

Costanzo (et al., 1998) procedures and methods were followed for analyzing soil ice nucleating agents. In order to test the activity of inorganic contents on ice nucleating agents, the temperature of crystallization was recorded. A quantity of air dried soil (100 mm^3) was placed in a 5 ml polypropylene microfuge tube and 12.5 µl of water (from reverse osmosis ultrapurification system) was added (Costanzo et al., 1998). The contents were mixed and then centrifuged (180g, 3 mm (1500 rpm for 3 minutes)). A 36 gauge copper-constantan thermocouple was taped to the tubes exterior. The tubes were then placed in dry 20 ml test tubes. Samples were chilled by submerging the test tubes in a refrigerated glycol bath. Once samples were equilibrated to 0° C, they were cooled until water within the samples crystallized. The T_c (temperature of crystallization) of each sample was read from the output of a datalogger to which the thermocouples were connected. All microfuge tubes and utensils were autoclaved to eliminate organic ice nuclei.

Inorganic and Organic Ice Nucleating Agents

Water extractable ice nuclei was measured by washing each soil sample (0.5 g of water per gram of soil) until 10 µl has been reached (Costanzo et al., 1998). Samples were centrifuged (180g, 3 mm (1500 rpm for 3 minutes)) (Costanzo et al., 1998). The supernatant was put through disk filter (5 mm) to remove fine particles. A 10 µl sample of washings was drawn into the center of a 20 µl capillary tube. The tube's ends were sealed with clay. Following the same procedure as before, a 36 gauge copper constantan thermocouple was taped to the side and then inserted into a dry 20 ml test tube. The tube was submerged in an ethanol bath. After samples equilibrate at 0° C, they were cooled until they froze. The potency of ice nuclei was estimated compared to the mean temperature of crystallization of washings with sterilized deionized water (Costanzo et al., 1998).

Statistical Analysis

Significance of statistical analyses was accepted at $P < 0.05$. Data were processed using Microsoft Excel and Sigma Plot and statistical analyses were conducted using R and Statistical Analysis Systems (SAS).

Results

Effect of turtle nesting on bulk density

Results of 20 pseudo turtle nests versus unexcavated ground cores along a transect in the notch and cell 5 show there is no significant difference between pseudo dug turtle nests and unexcavated surrounding ground cores. After and unsuccessful log transform was performed to normalize data with unequal variances of bulk density (g/cm^3) a Two-sample Kolmogorov-Smirnov test was performed ($D = 0.35$, p-value > 0.5; N=20 “pseudo” cores, N=20 “ground” cores).

Texture

Results show that there was no significant difference in percentage of sand silt and clay between fall and spring emerging nests from the randomly selected study nests out of the 2007 Poplar Island Nests (Figures 9 and 10). Comparison of fall versus spring emerging nests in sand and silt was conducted using a Wilcoxon rank sum test with continuity correction (Sand: $W = 289.5$, p-value = >0.05, Silt: $W = 365.5$, p-value = >0.05). Comparison of fall versus spring emerging nests for clay was done using a two-sample Kolmogorov-Smirnov test ($D = 0.2627$, p-value = >0.05). Sample size was the same for fall and spring emerging nests for sand, silt and clay (N=21 for fall emerged nests N=29 for spring emerged nests).

Organic Matter

A Wilcoxon rank sum test with continuity correction found no difference in the organic matter between fall and spring emerging nests ($W = 240.5$; p-value = >0.05, N= 16 for fall emerging nests, N= 26 for spring emerging nests) (Figure 11).

Bulk Density

There was a difference in the mean bulk density values between spring emerging nests and fall emerging nests (Figures 12 and 13). Nests that emerged in the fall had lower bulk density values (looser, lighter soil) compared to spring emerged nests that had higher bulk density values (heavier, more compacted soil). A Wilcoxon rank sum test with continuity correction was reveals a significance ($W = 182.5$, p-value <0.05; $N=21$ fall emerging nests, $N=30$ spring emerging nests). A Wilcoxon ran sum test was performed because data was not normally distributed and had equal variances.

Inorganic Ice Nucleating Agents

Using a repeated measures ANOVA, a difference in the temperature of crystallization between fall emerging nests and spring emerging nests was detected (Repeated ANOVA measures, p-value <0.0001; Figure 14).

Organic Ice Nucleating Agents

There was a difference in organic ice nucleating agents present between fall and spring emerging nests using a Wilcoxon rank sum test with continuity correction ($W = 123$, p-value <0.05; $N= 16$ for spring emerged nests, $N=10$ fall emerged nests) (Figure 14).

Lay Date

There is no effect of lay date on emergence time (fall or spring) in 2005 and 2007. A Wilcoxon rank sum test with continuity correction was used for 2005 and 2007 (2005: $W = 1464.5$, p-value > 0.5; $N=128$ fall emerged nests, $N= 23$ spring emerged nests, 2007: $W = 2933$, p-value > 0.5; $N= 108$ fall emerged nests, $N=50$ spring emerged nests).

However there was a lay date effect in 2006 where nests laid early in the season emerged in the fall compared to nests laid later in the season, which emerged in the spring Wilcoxon rank sum test with continuity correction ($W = 694$, p-value < 0.05; $N=62$ fall emerged nests, $N=30$ spring emerged nests) (Figure 15).

Correlation Analysis

We conducted a correlation analysis to identify relationships among potential causal factors relating to fall or spring emergence. Variables included: lay date, clutch size, number of hatchlings, mean clutch mass, mean egg mass, mean hatchling mass, survivorship (number of eggs/ number of hatchlings), emergence time (spring or fall), sand, silt, clay, organic matter, mean nest bulk density values, mean nest porosity values, mean nest inorganic ice nucleating agents, and mean nest inorganic and organic ice nucleating agents.

Results show there is a correlation between survivorship and mean bulk density values ($R = 0.427$, $p < 0.05$, $N=25$); organic and inorganic INA and number of hatchlings ($R= -0.450$, $p < 0.0408$, $N=21$); silt and number of hatchlings ($R= 0.298$, $p <0.05$, $N=47$). There is a negative correlation between sand and bulk density ($R = -0.440$, $p <0.002$, $N=47$). There are also obvious correlations including: clutch mass and clutch size ($R =0.904$, $p <0.001$, $N=28$); hatchling size and clutch size ($R= 0.484$, $p <0.009$, $N=28$); hatchlings and clutch mass ($R = 0.507$, $p <0.006$, $N=28$); hatchlings and survivorship ($R=0.785$, $p<0.001$, $N=25$); clay and sand ($R= -0.79$, $p <0.001$, $N=47$).

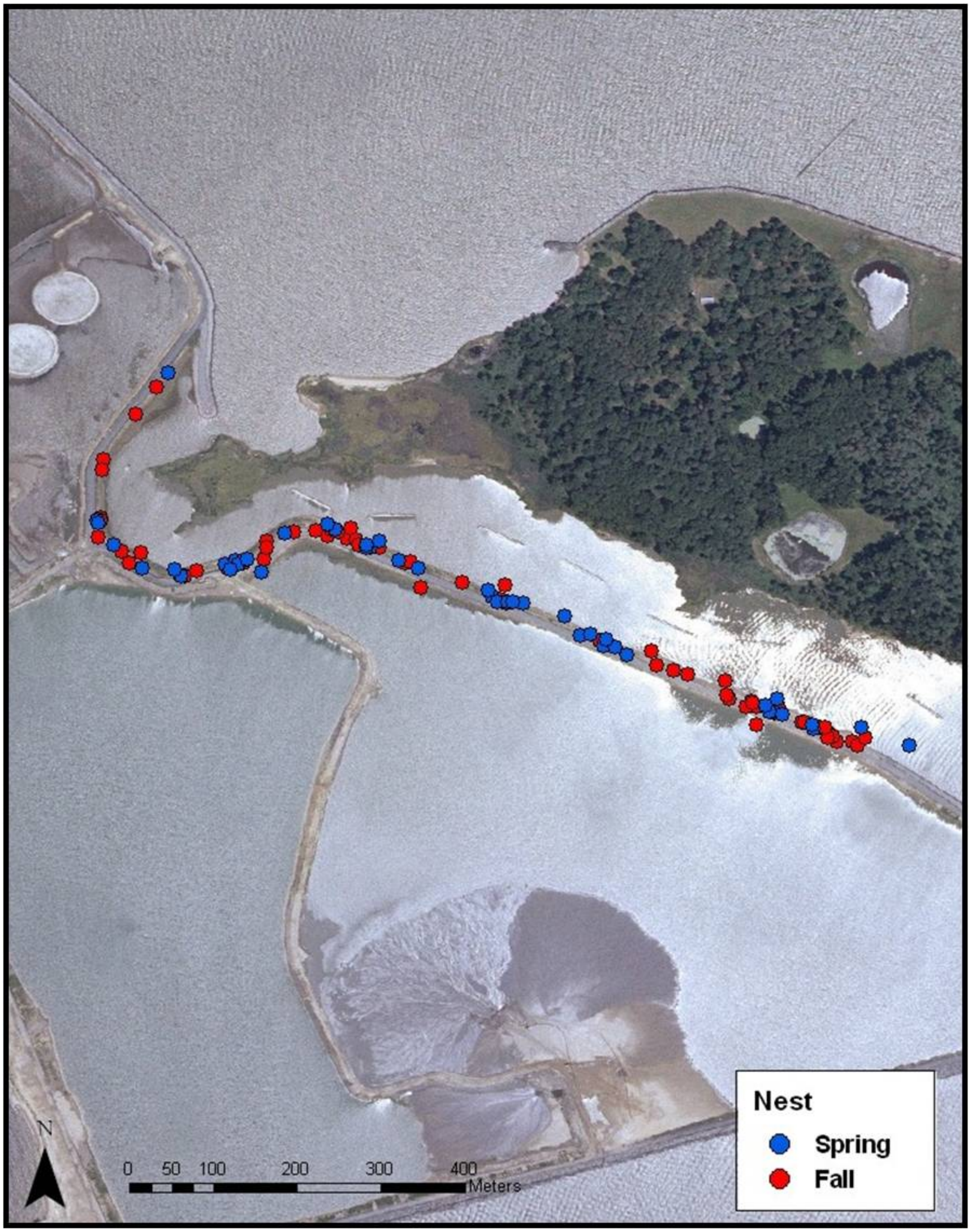

Figure 8. 2007 Spring and Fall emerging nests along the notch and Cell 5. Fall and spring nests tend to be clumped together in areas.

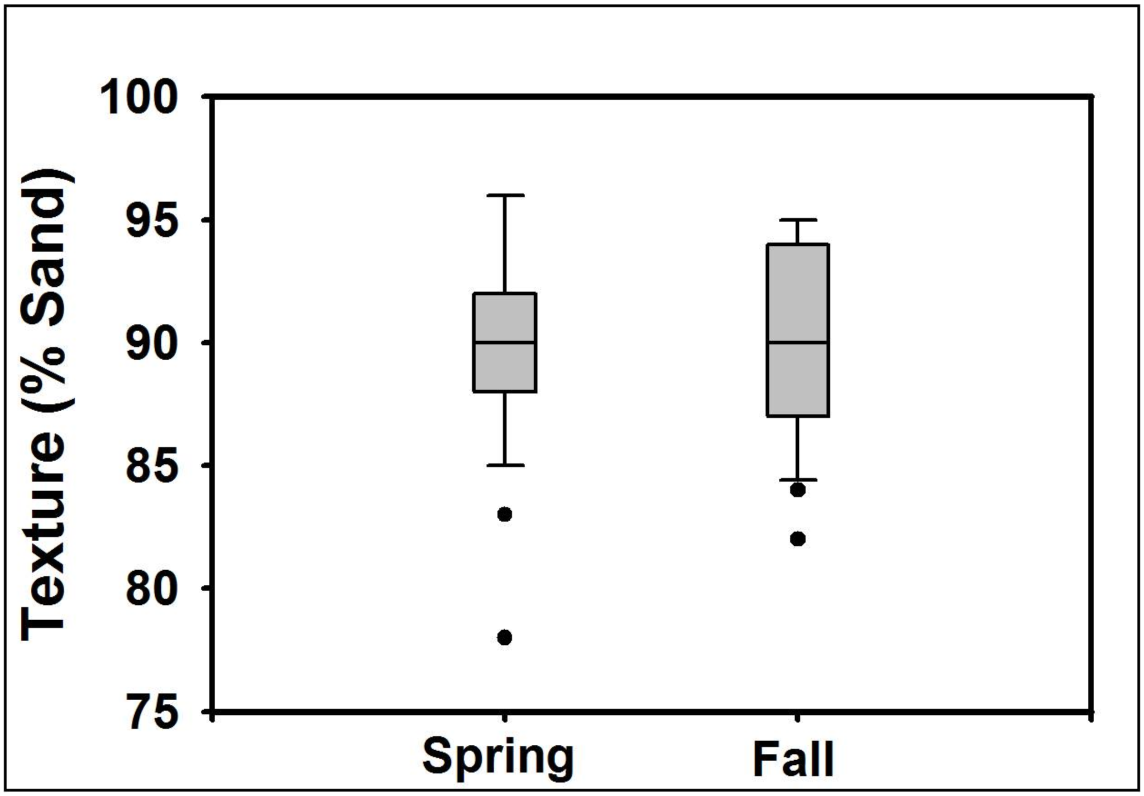

Figure 9. Percent of sand in 2007 Fall and Spring emerging nests. (Outliers are represented by black dots). Wilcoxon rank sum test with continuity correction (Sand: W = 289.5, p-value = >0.05; N=21 for fall emerged nests N=29 for spring emerged nests).

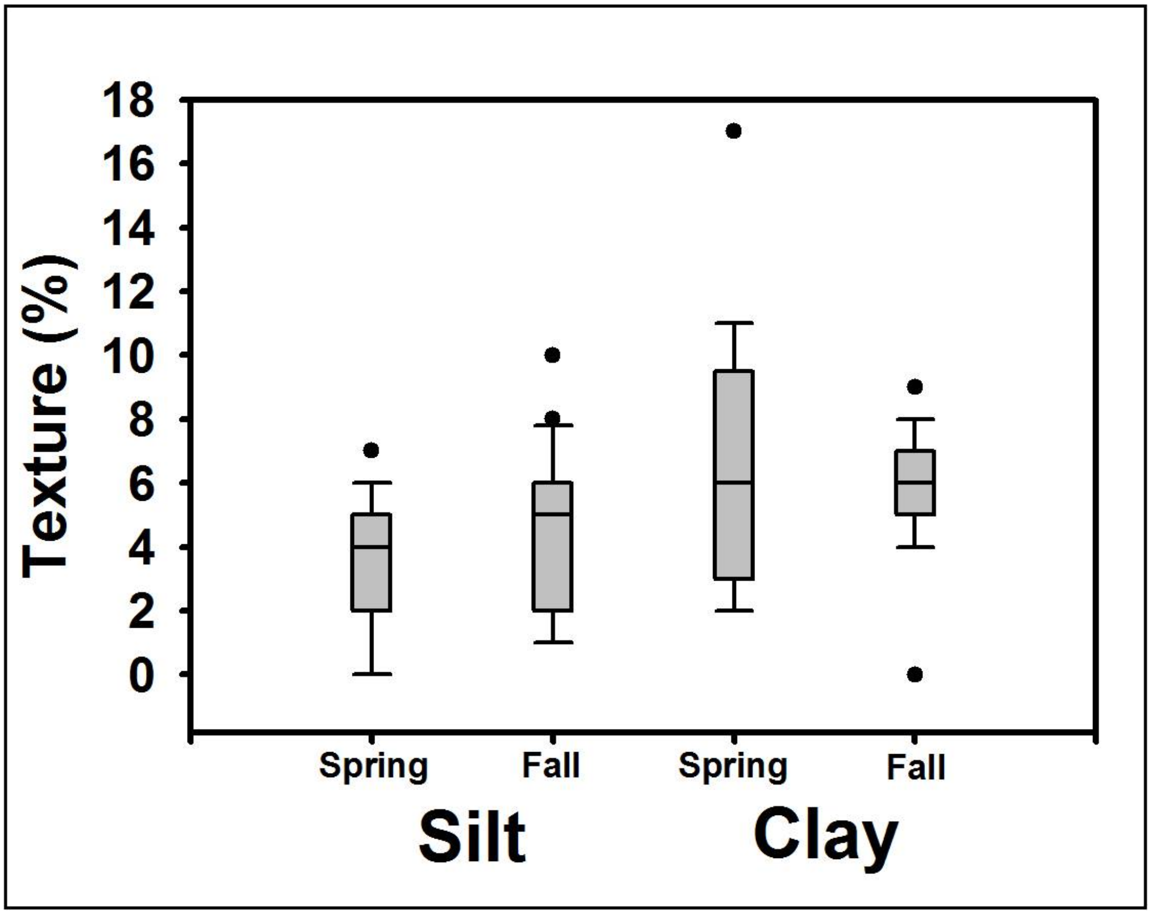

Figure 10. Percent of silt and clay in 2007 Fall and Spring emerging nests. (Outliers are represented by black dots). Wilcoxon rank sum test with continuity correction (Silt: W = 365.5, p-value = >0.05); Two-sample Kolmogorov-Smirnov test (Clay: D = 0.2627, p-value = >0.05). Sample size was the same for fall and spring emerging nests for silt and clay (N=21 for fall emerged nests N=29 for spring emerged nests).

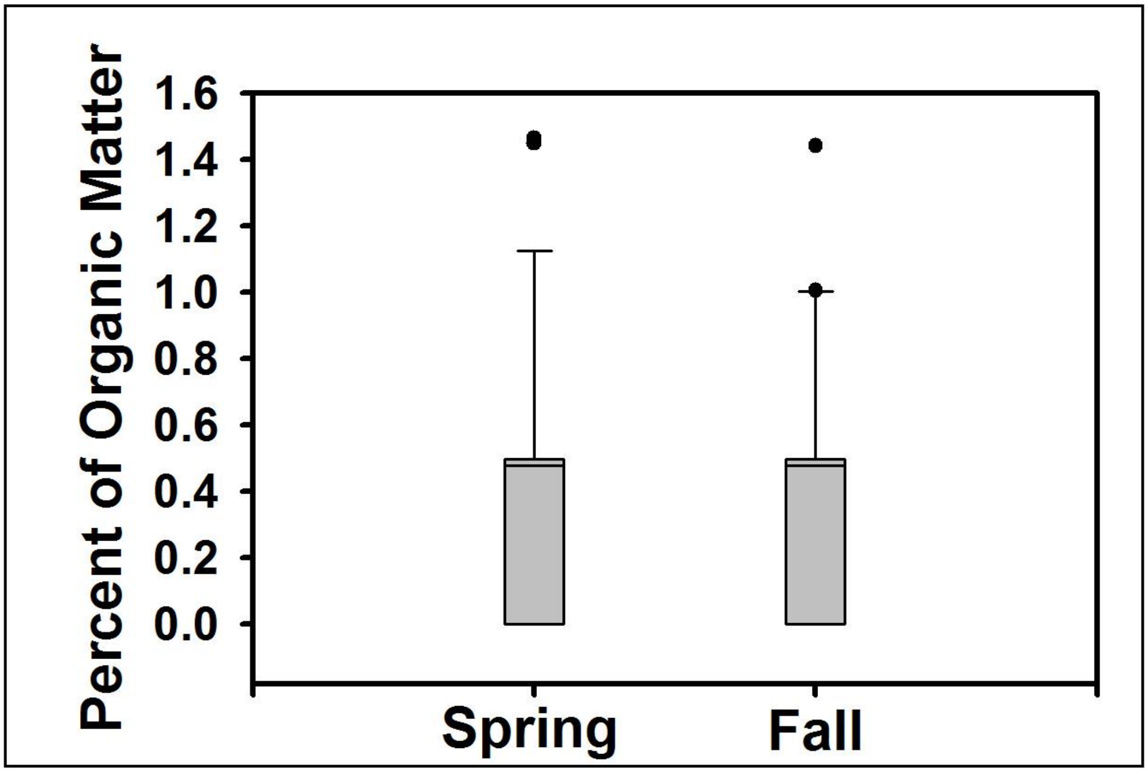

Figure 11. Percent of organic matter in 2007 fall and spring emerging nests. (Black dots represent outliers). A Wilcoxon rank sum test with continuity correction (W = 240.5; p-value = >0.05, N= 16 for fall emerging nests, N= 26 for spring emerging nests).

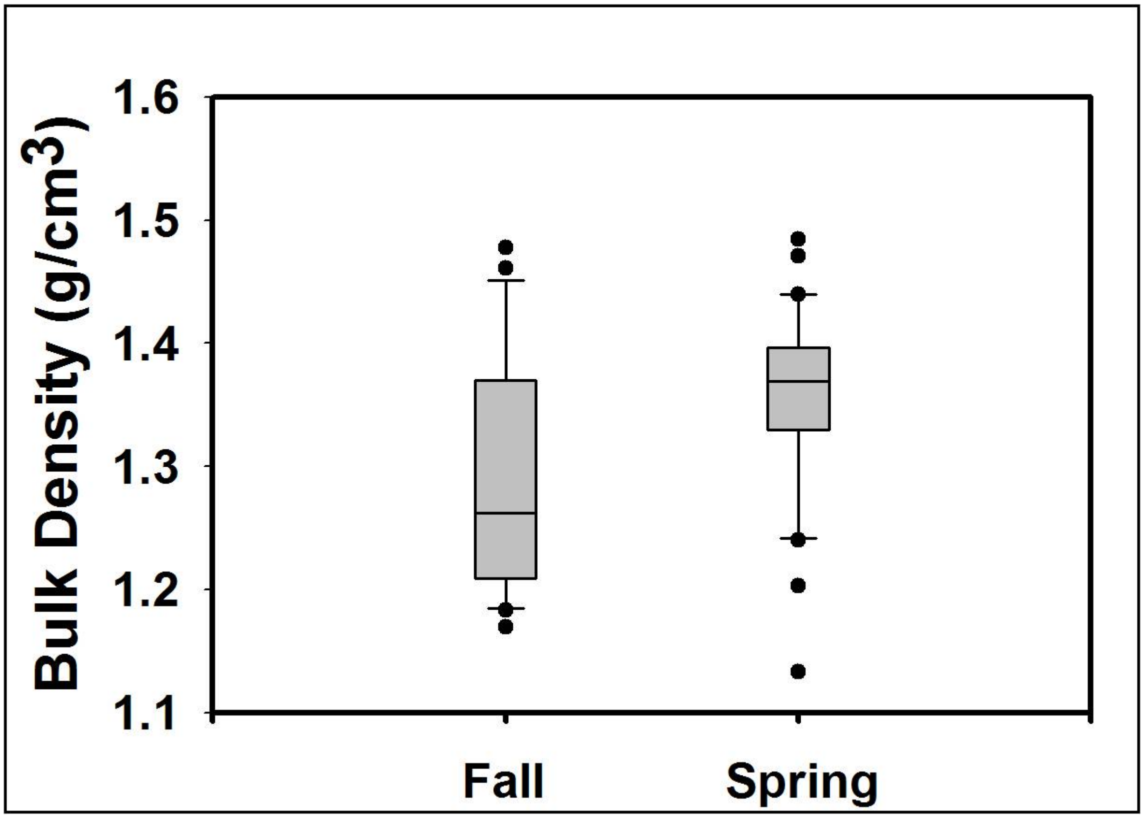

Figure 12. Bulk Density of 2007 fall and spring emerging nests. (Black dots represent outliers). A Wilcoxon rank sum test with continuity correction (W = 182.5, p-value <0.05; N=21 fall emerging nests, N=30 spring emerging nests).

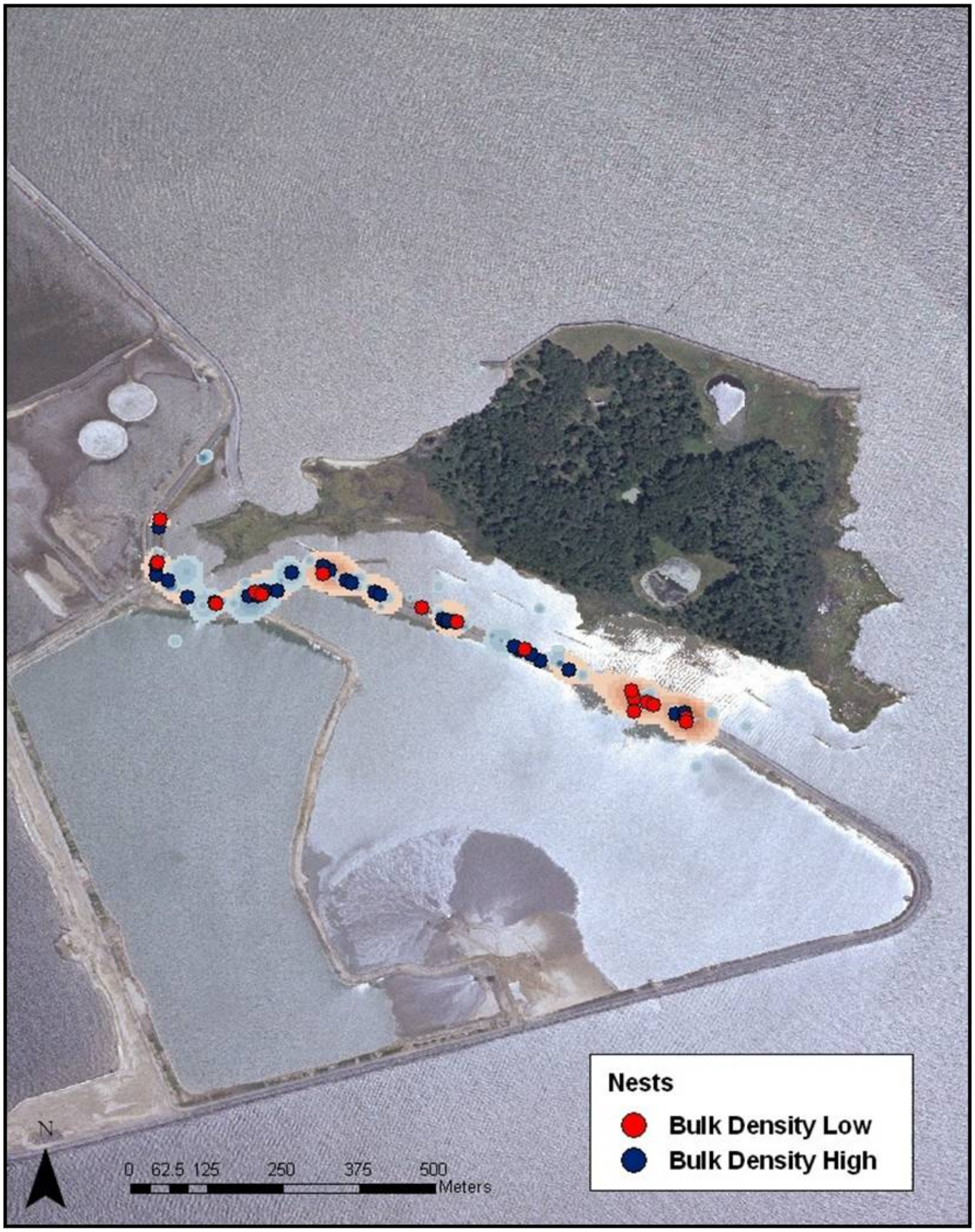

Figure 13. 2007 Fall and spring bulk density with a hot spot of emergence timing underneath from years 2004-2007. Fall emerging nests are light red and spring emerging nests are light blue. This is a visual representation showing areas with high bulk densities (more compacted) emerged in the spring compared to areas with low bulk density (less compacted) emerged in the fall.

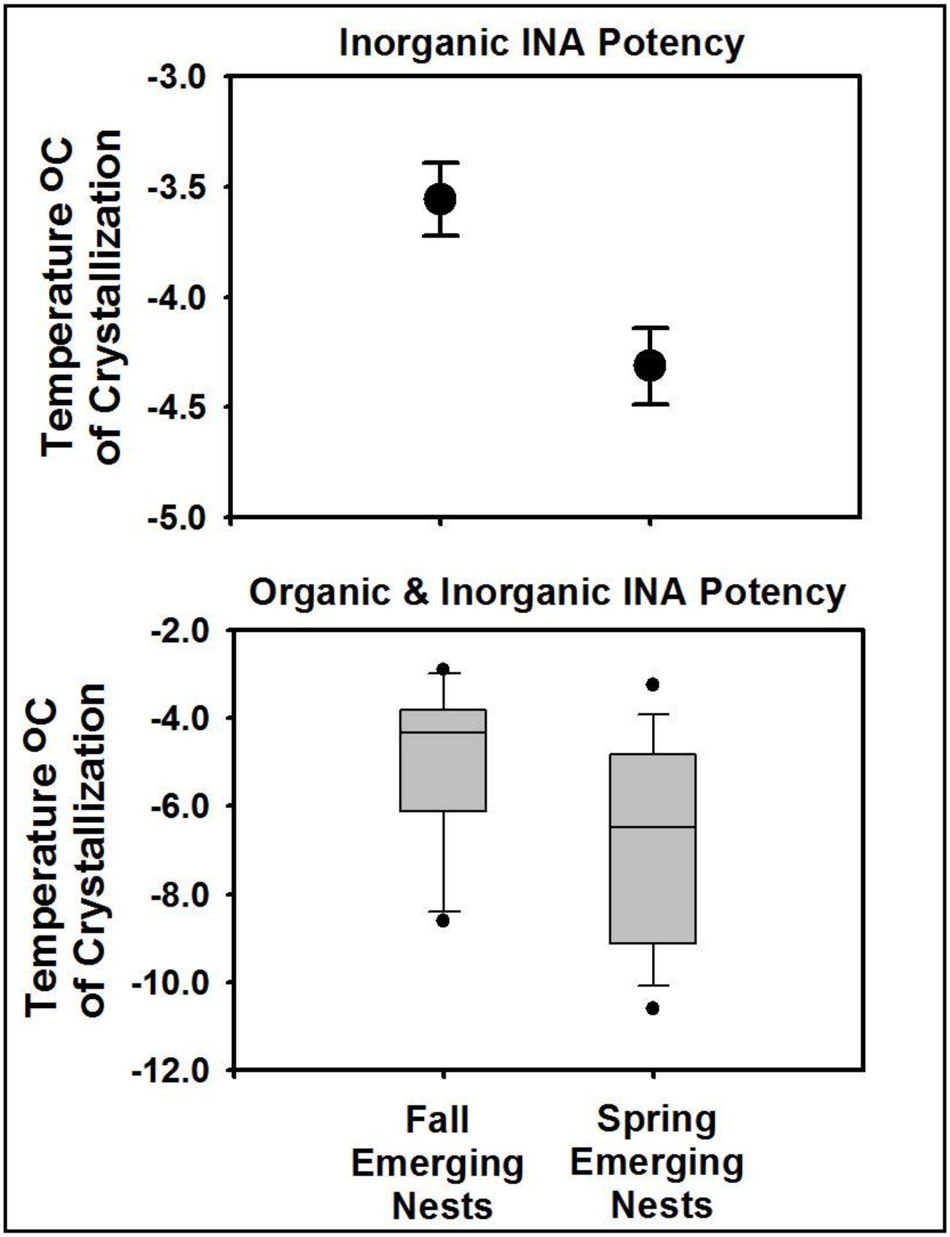

Figure 14. 2007 Inorganic INA and Organic and Inorganic INA potency (as a measure of Temperature of Crystallization) in fall and spring emerging nests. Inorganic INA (Repeated ANOVA measures, p-value = <0.0001; N=9 for spring emerging nests, N=10 fall emerging nests). Inorganic and organic INA (Wilcoxon rank sum test with continuity correction W = 123, p-value <0.05; N= 16 for spring emerged nests, N=10 fall emerged nests).

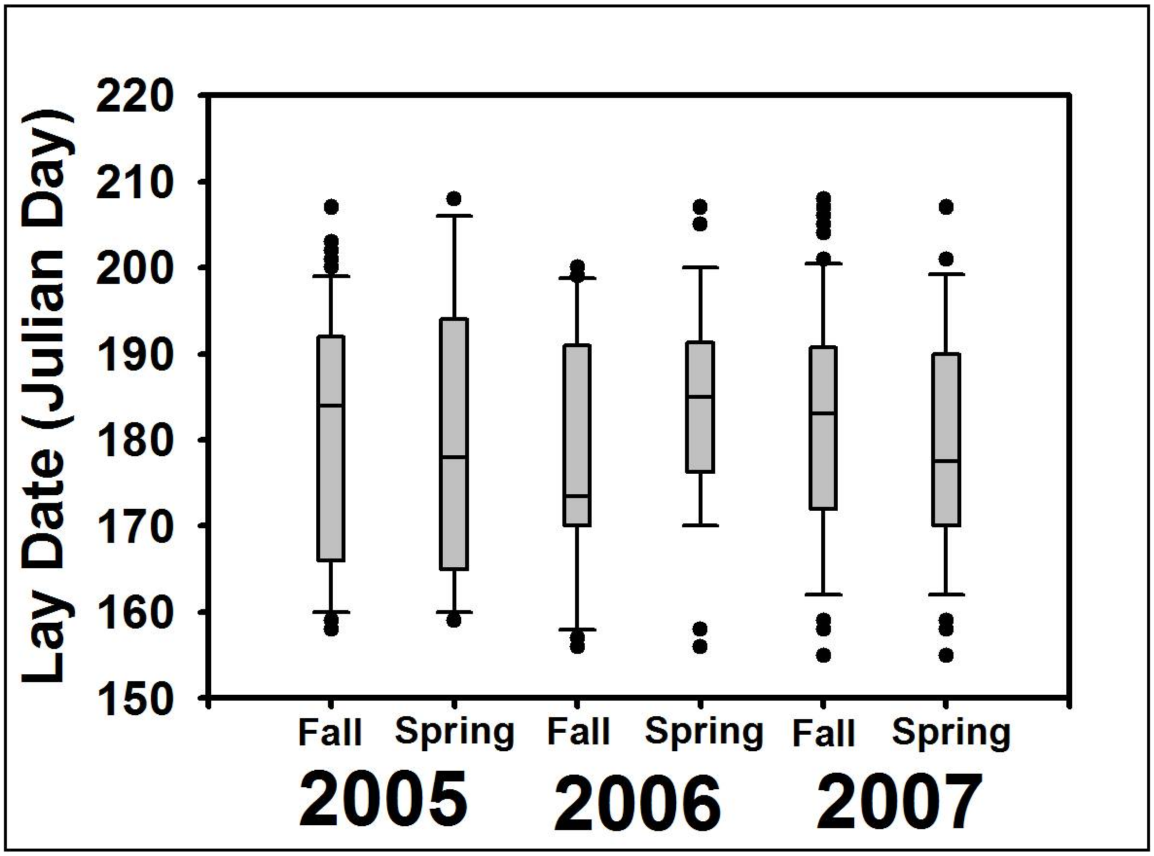

Figure 15. Lay date of fall and spring emerging nests for PIERP 2005-2007 nests. There was no lay date difference between fall and spring emerging hatchlings in 2005 and 2007 however there was a lay date effect on emergence time in 2006. A Wilcoxon rank sum test with continuity correction was used for 2005 and 2007 (2005: W = 1464.5, p-value > 0.5; N=128 fall emerged nests, N= 23 spring emerged nests, 2007: W = 2933, p-value > 0.5; N= 108 fall emerged nests, N=50 spring emerged nests). A Wilcoxon rank sum test with continuity correction (W = 694, p-value < 0.05; N=62 fall emerged nests, N=30 spring emerged nests).

Discussion

M. terrapin nest emergence timing is affected by bulk density values and the presence of ice nucleating agents (as a measure of crystallization temperature). There was no difference in survival, oviposition, clutch size, texture (sand, silt, clay) and organic content in fall and spring emerging nests. Whether terrapin hatchlings overwinter in the nest as a result of compaction due to being trapped or because they remain due to good winter hibernacula as a result of characteristic INA is unknown. Fall nests have lower bulk density values and are therefore less compacted. Further studies on *M. terrapin* hatchling overwintering strategies (freeze tolerance or freeze intolerance) could prove useful in 1) identifying overwintering strategy method in field conditions and 2) identifying compaction (bulk density) as either enhancing hibernacula or as a barrier to emergence.

Results show that there is no difference from within nest survivorship from 2004-2007 on Poplar Island between fall and spring emerging nests. Therefore, one can conclude that natural selection is not favoring one emergence strategy over another in *M. terrapin;* which rules out the biological cue of evolutionary response as a factor that influences emergence timing.

Results show that date of oviposition did not influence emergence timing in either spring or fall emerging hatchlings in *M. terrapin*. Therefore, the date of oviposition, and indirectly, how late a female lays a nest in a season does not affect emergence timing in *M. terrapin*. Clutches laid later in the season were thought to overwinter because of insufficient number of warm days to complete development; therefore, hatchlings remain in the nest until the following spring (Gibbons and Nelson, 1978). Results show that an internal clock due to date of oviposition does not stimulate nest emergence in *M. terrapin* hatchlings. Internal timing is a biological cue that influences emergence timing in hatchlings; it is an internal “clock” that starts when eggs are laid until emergence.

Terrapin hatchling nest emergence time is related to the presence of ice nucleating agents. Using temperature of crystallization as a potency measure of ice nucleating agents present, fall emerging nests had ice nucleating agents (INAs) present in both the inorganic INA test as well the inorganic and organic INA test. Fall emerging nests crystallized at a higher temperature compared to spring emerging nests. Based on the percent of organic matter present, there is no difference between fall and spring emerging nests. Therefore, the inorganic ice nucleating agents present are the ones affecting the temperature of crystallization, and are driving the INA potency (more INAs are present if temperature of crystallization occurs at a higher temperature) rather than organic INAs. The presence of inorganic INAs, mineral crystalloids such as quartz and silica, found in sand may affect emergence timing in nests. It is possible that the INAs present in fall emerging nests may provide an adverse overwintering environment in supercooled animals.

Compaction can affect emergence timing in three ways: 1) the ground may be too compacted for hatchlings to successfully excavate; 2) indirectly effect embryonic development effecting temperature, hydric, and gas exchanges; or 3) compaction of the nest chamber influences the proximity of INA to hatchlings and therefore determines the condition of winter hibernacula.

One physical factor influencing nest emergence timing is nest entrapment. Results show that fall emerged nests had a much lower bulk density value, and were therefore less compacted compared to spring emerging nests. Therefore, it may be probable that hatchlings that overwinter in their natal nest cannot break the nest chamber and are trapped. *Chrysemys picta* hatchlings were unable to penetrate the roof of the nest chamber when it has been hardened by the sun during the incubation period due to compaction (DePari, 1996). *Chrysemys picta* hatchlings from field nests in sand were more likely to emerge in the fall than hatchlings from nests constructed in soil (DePari, 1996).

Heat is an important resource for embryonic development and nest emergence activities. Thus thermal insufficiency may account for failure of some clutches to emerge in autumn. Porous well-drained soils can accelerate evaporative water loss (EWL), and heavier soils such as clays and clay loams retain moisture and thus tend to heat and cool relatively slowly (Costanzo et al., 2008). Compaction and more variation in clay may create a hypoxic environment for developing embryos. After hatching from eggs, neonates have energy reserves in the form of yolk lipids and proteins. Nest substrate may have an effect on the quality of yolk, since it is determined by both the amount of nutrients maternally invested and the thermal and hydric conditions during egg incubation. Perhaps *M. terrapin* in the “lighter” soil of fall emerged nests may heat quickly, which may be ideal for embryonic development but would remain unsuitable for overwintering. On the other hand, spring emerging nests may have had a better overwintering environment.

Compaction may also influence overwintering hibernacula. Porous soils contain large voids that can fill with ice, exposing hatchlings (Costanzo et al., 2008). While there was no difference in sand, silt, and clay in fall and spring emerging nests, there was a significant difference of compaction, and as result porosity. Nests that emerged in the fall had a higher porosity (lighter and less compacted) compared to nests that emerged in the spring. Compacted nests may be better overwintering hibernacula because INA (which would be detrimental for a supercooled hatchling) is kept away due to the compacted nest and the clay which would absorb water. In less compacted soils, hatchlings could be infiltrated with INA. Movement of hatchlings as they emerge from the eggshell may displace substrate above the nest chamber, which falls to the bottom, displacing hatchlings toward the surface. Studies found this phenomenon occurs in sea turtle nests, and that the effort of emergence from the nest chamber must be shared by siblings (Trullas and Paladino, 2007). However, in a well formed sealed chamber, the integrity of this chamber may not be compromised by the movement of hatchlings as they emerge from their eggs (DePari, 1996). Thus, friable soils are prone to infiltrating the nest cavity, placing hatchlings at an increased risk of freezing through INA contamination and inoculative freezing (Costanzo et al., 2008).

Malaclemys terrapin hatchling overwintering strategy

Whether hatchlings supercool or freeze as a strategy of cold hardiness is debated in literature (Packard and Packard 2001, 2003, 2004; Costanzo et al., 2006; Costanzo et al., 2000). Laboratory studies have found that *M. terrapin* hatchlings can use either freezing or supercooling as a method to survive subzero environments (Baker et al., 2006). Terrapins exhibit an extraordinary ability to supercool and remain unfrozen down to -15° C (Baker et al., 2006). Supercooling is also promoted by small body size. *Malaclemys terrapin* hatchlings are also capable of recovering from freezing at -2.5° C for at least seven days (Baker et al., 2006). They speculate that nesting soils have large amounts of INAs that would trigger freezing and death in supercooled turtles; therefore turtles would likely use a freeze tolerant strategy to overwinter (Baker et al., 2006).

Based on this study's results of compaction (more compacted nests emerged in the fall, less compacted nests emerged in the spring) and INA potency (nests that had higher amounts of INA emerged in the fall, nests that had lower amounts of INA emerged in the spring), it suggests that *M. terrapin* would use supercooling as a cold hardiness strategy in the field. Soil compaction may prove to be an effective barrier keeping INA away from supercooled hatchlings. Hatchlings that emerged in the fall in nests had high amount of INAs (as a measure of INA potency due to temperature of crystallization) present. Therefore, hatchlings would be actively avoiding overwintering hibernacula with high levels of INA present if they use the supercooling method.

Physical factors affecting terrapin nest emergence timing include; nest entrapment, suboptimal hibernacula (either due to compaction or presence/ absence of INAs), and possible suboptimal incubation environment. Biological cues such as evolutionary responses and internal timing do not seem to have an effect on emergence timing of *M. terrapin* hatchlings. This study further supports the conclusion that regional and local variation in soil characteristics can impact nest emergence timing in hatchling turtles (Costanzo et al., 2008). Further studies on biological and environmental factors that affect emergence timing are important in understanding the developmental environment and success of turtle nests (Wyneken et al., 2008). Future research may ultimately show that the driving force for hibernation emergence is an interaction between extrinsic and intrinsic influences.

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